

# CenterPoint Oklahoma Demand Programs Annual Report 2021

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May 1, 2022

PY 2021 DEMAND PROGRAM ANNUAL REPORT  
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## Executive Summary

On October 7, 2010, CenterPoint Energy Resources Corp. d/b/a CenterPoint Energy Oklahoma Gas (“CenterPoint Oklahoma” or the “Company”) proposed a comprehensive portfolio of Conservation Improvement Programs (“CIP,” and as a whole, the “CIP Portfolio”) in response to the Oklahoma Corporation Commission’s (“OCC” or the “Commission”) Rules for Demand Programs, OAC § 165:45-23-1 et seq. On March 25, 2011, the Commission approved the program portfolio in Order No. 583869 in Cause No. PUD 201000148, and CenterPoint Oklahoma began to implement the program portfolio thereafter in 2011. On February 1, 2012, the Commission approved modifications and additions to the Company’s previously approved CIP portfolio in Order No. 593649 in Cause No. PUD 201100149. On August 13, 2013, the Commission approved an updated CIP portfolio for program years (“PY”) 2014 - 2016 in Order No. 616573 in Cause No. PUD 201300085. On October 26, 2016, the Commission approved an updated CIP portfolio for PY 2017 - 2019, in Order No. 657250 in Cause No. PUD 201600263. On August 8, 2019, the Company requested approval of an updated comprehensive CIP Portfolio for PY 2020 - 2022. The OCC approved this request on December 10, and CenterPoint Oklahoma began delivery of this CIP Portfolio on January 1, 2020, in Order No. 706092 in Cause No. PUD 201900060. On January 10, 2022, CenterPoint Oklahoma was acquired by Summit Utilities, Inc. and is now operating as Summit Utilities Oklahoma, Inc.. This report will reference CenterPoint Oklahoma as the program was administered by CenterPoint Oklahoma for PY 2021.

This report is filed in response to the Commission’s reporting requirements specified in OAC § 165:45-23-7, which requires public utilities to report the performance of their energy efficiency programs for the preceding program year. Consistent with the requirements, this report will outline the activities and results of the Company’s CIP Portfolio performance for PY 2021.

CenterPoint Oklahoma implemented and administered the following CIP programs in PY 2021:

- **CenterPoint Energy Education Program (CEEP)** - Educates residential and commercial customers about their energy usage and provides low-cost to no-cost tips on how to conserve energy.
- **Residential Home Energy Reports Program** - An educational and behavioral change program which provides individualized information and recommendations regarding energy usage through Home Energy Reports, sent to approximately 39,551 CenterPoint Oklahoma customers. The direct mail Home Energy Reports utilize energy usage data with customer demographic, housing, and GIS data to develop specific, targeted recommendations that educate and motivate customers to reduce their energy consumption.

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- **Natural Gas Equipment Program** - Promotes the installation and use of high-efficiency natural gas appliances that include water heaters, space heaters, clothes dryers, and gas ranges, as well as self-install smart thermostats for residential customers. Commercial customers are encouraged to install high-efficiency natural gas water and space heating. Inducements are offered to customers with an active account with CenterPoint Oklahoma and includes the following components:
  - **Water Heater** - CenterPoint Oklahoma provides a \$500 inducement to customers who upgrade their water heater to a tankless system and provides a \$900 inducement to customers who switch from electric resistance water heating to natural gas tankless water heating system. Plumbers that install gas tankless systems for a natural gas water heater upgrade or an electric to natural gas conversion are eligible for a \$50 trade ally incentive for every qualifying inducement.
  - **Natural Gas Furnace** - Furnace inducements range from \$300 to \$500 to residential and commercial customers that purchase and install high-efficiency natural gas furnaces. Customers that switch from electric resistance heating and heat pumps to a more efficient natural gas furnace as their primary heating source receive a \$2,000 inducement. Customers who receive a rebate for a qualifying furnace are also eligible for an additional \$60 incentive when a qualified Smart Thermostat is installed.
  - **Clothes Dryer** - Provides up to a \$450 inducement to qualified residential customers for the purchase and installation of natural gas dryers. A \$50 trade ally incentive is also available for each qualifying inducement.
  - **Cooking Range** - Provides up to a \$300 inducement to residential customers who replace electric cooking ranges with more efficient natural gas ranges. In addition, a \$50 trade ally incentive is offered to encourage trade allies to stock and sell natural gas cooking ranges.
  - **Multi-Unit Market Transformation** - Promotes efficient water heating and space heating solutions to multi-unit developers through inducements ranging from \$900 to \$2,000. Trade ally rebates are also available at \$50 for qualified equipment installations.
- **High Efficiency Homes Program** - Provides a \$1,000 inducement to customers or builders who construct new homes equipped with efficient natural gas appliances.

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- **Low-Flow Showerhead and Faucet Aerator Program** - Provides residential customers with free low-flow showerhead and faucet aerator kits that, when installed, will conserve water, reduce energy usage, and save customers money.
- **Low-Income Saving Homes Program** – Provides weatherization retrofits that will improve the efficiency and comfort of CenterPoint Oklahoma’s low-income and hard to reach residential customers.
- **Natural Gas Commercial & Industrial (“C&I”) Solutions Program** – Administered by CLEAResult, the Natural Gas C&I Solutions Program provides financial incentives and technical consulting assistance designed to help commercial and industrial customers identify, develop and implement cost effective energy efficiency solutions at their facilities. The Natural Gas C&I Solutions Program also provides prescriptive rebates for qualified boiler and foodservice equipment purchases. The program contains the following components:
  - **Direct-Install** - Measures target small to mid-size commercial customers. It is a turnkey equipment replacement program designed to reduce customer energy usage costs through the installation of low-flow pre-rinse spray valves, faucet aerators, showerheads, weather-stripping, and steam traps.
  - **No-Cost Facility Audit** - Program representatives will perform a valuable no-cost facility audit, to determine if any natural gas is being used inefficiently and help identify cost-effective solutions to reduce energy waste and save money.
  - **Custom Project Measures** - target commercial and industrial customers. Projects identified will be eligible for custom incentives based on final program design, after applying documented and defensible calculated energy savings.

**Prescriptive Programs Include:**

- **Commercial Food Service Program** – For the PY 2020 - 2022, the Commercial Food Service Program is now under the C&I Solutions umbrella and administered by CLEAResult. This Program promotes the reduction of natural gas energy usage for commercial food service customers via inducements ranging from \$300 to \$2,400 for the purchase and installation of qualified new energy efficient food service equipment. Trade ally incentives ranging from \$45 to \$225 are also available for qualifying equipment.

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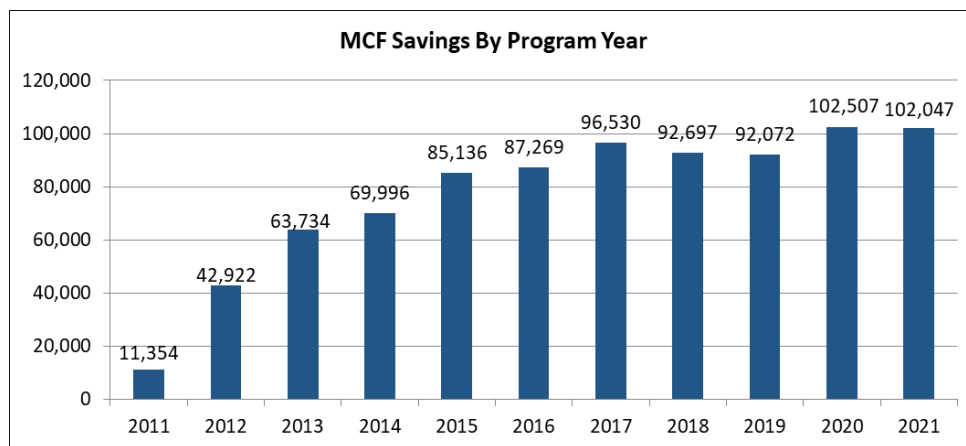
- Commercial Boiler Program - For PY 2020 - 2022, the Commercial Boiler Program is now under the C&I Solutions umbrella and administered by CLEAResult. This Program encourages commercial customers to install efficient natural gas comfort heating boilers via inducements ranging from \$1,400 to \$2,000 per MMBTU of input for the purchase of qualified new energy efficient boilers. Additionally, inducements are available for the purchase and installation of boiler burner replacements.
- In PY 2021, the CIP Portfolio produced net energy savings of 102,047 Mcf and remains cost-effective despite some programs achieving lower energy savings than in previous years. The programs generated a net economic benefit of \$1,638,764 and helped participants save money through a combination of prescriptive and custom rebates, direct-install measures, energy usage reports, and facility audits. Key insights from PY 2021 program delivery include:
  - **Natural Gas Equipment program experienced an increase in participation** – Despite higher equipment cost, labor shortages, and supply chain issues, the Natural Gas Equipment program experienced an increase in both participation and energy savings. The energy savings were 15% higher than the previous year.
  - **Demand for fuel-switching rebates remains high** – In PY 2021, 125 participants utilized the Company’s fuel-switching rebates available for natural gas space heating, water heating equipment, and multi-family programs. Additionally, 30 participants received rebates for natural gas dryers and ranges. These fuel-switching rebates remain strong inducements for customers to utilize high-efficiency natural gas equipment in their homes and businesses.
  - **High Efficiency Homes Program participation continues to grow** – In PY 2021, inducements were provided for 142 new homes equipped with high-efficiency natural gas heating equipment, water heating equipment, and a third natural gas appliance. The Company’s ongoing efforts to educate builders on the value of the program continue to influence builders to install efficient natural gas equipment in new homes.
  - **Natural Gas Commercial Solutions Program** – PY 2021 was another year of strong growth for the Company’s Natural Gas Commercial Solutions Program. The direct-installation measures continued to be an effective inducement to drive commercial energy savings at no cost to participants. The custom portion of the program provided participants with technical assistance, recommendations, and financial inducements to implement energy saving measures such as insulation upgrades and equipment controls. The custom program continues to grow as more industrial customers recognize the value of DSM programs. There was a total of 5 pieces of equipment rebated through the Foodservice and

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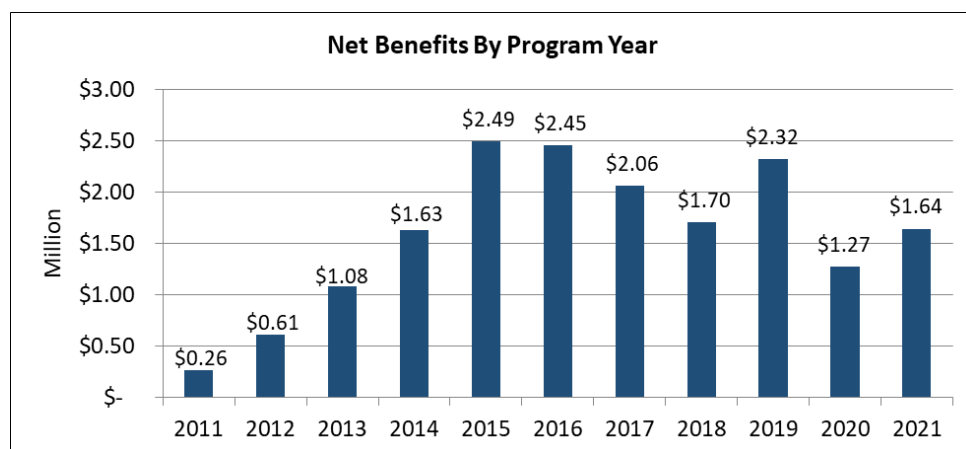
Boiler portion of the program. The foodservice industry in particular continues to be impacted by the Pandemic's long effect on the economy. The C&I program delivered energy savings of 47,163 Mcf, which was 130% of the program's filed savings goal.

- **Home Energy Reports decrease in participation** – Program savings decrease in PY2021 as participants used more energy than in previous years. However, this program continues to be an effective channel to educate customers, modify behavior, and drive energy savings. In PY 2021, the program delivered net energy savings of 32,087 Mcf, and reports were also used to cross-promote other program offerings in the Company's CIP Portfolio.

**Figure 1: Energy Savings by Program Year**



**Figure 2: Net Benefits by Program Year**



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The remainder of this report is organized according to the OCC's reporting requirements specified in OAC § 165:45-23-7(c).

**§ 165:45-23-7(c)(1): Demand Programs by Customer Category**

**OAC § 165:45-23-7(c)(1): The name of Demand Program listed by Category**

Table 1 lists the customer categories (by class) served by each Conservation Improvement Program delivered by CenterPoint Oklahoma in PY 2021.

**Table 1: Programs & Customer Categories**

Program	Customer Category Served			
	Residential	Commercial CS-1	Commercial CS-2	Commercial LCS
Natural Gas Equipment Program	✓	✓	✓	✓
Low Flow Showerhead/Aerator	✓			
Home Energy Report	✓			
High Efficiency Home	✓			
Low Income Saving Homes	✓			
Natural Gas Commercial Solutions Program		✓	✓	✓
CenterPoint Energy Education Program	✓	✓	✓	✓

**§ 165:45-23-7(c)(2): Programs and Date Started**

**OAC § 165:45-23-7(c)(2): a list of all programs and the date each program started.**

The following programs were included in CenterPoint Oklahoma's PY2021 DSM portfolio:



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Programs	Start Date
• Natural Gas Equipment Program	January 1, 2020
• High Efficiency Homes Program	January 1, 2020
• Low-Flow Showerhead and Faucet Aerator Program	January 1, 2020
• Residential Home Energy Reports Program	January 1, 2020
• Low-Income Saving Homes Program	January 1, 2020
• Natural Gas Commercial Solutions Program	January 1, 2020
• CenterPoint Energy Education Program	January 1, 2020

On December 10, 2019, the OCC approved a new CIP Portfolio triennial plan for PY 2020 - 2022. On January 1 of 2020, CenterPoint Oklahoma began implementation of the new triennial plan consisting of the programs listed above, which included the consolidation of the natural gas clothes dryer, natural gas cooking range, and multifamily program into the Natural Gas Equipment program as measures. A residential low-income program was also added to the portfolio. Finally, the boiler and foodservice programs were consolidated into the Commercial and Industrial Program as measures.

### **§ 165:45-23-7(c)(3): Customer Participation**

**OAC § 165:45-23-7(c)(3): The number of Participating Customers per Demand Program.**

Listed on Table 2 is CenterPoint Oklahoma's PY 2021 CIP Portfolio participation results which had a total of 43,349 participants and measures installed.

**Table 2: Participation by Program**

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Program	Participants
Natural Gas Equipment Program	884
Low Flow Showerhead/Aerator	1,007
Home Energy Report	35,418
High Efficiency Home	142
Low Income Saving Homes	243
Natural Gas Commercial Solutions Program	5,655
CenterPoint Energy Education Program	NA
<b>Total</b>	<b>43,349</b>

Listed on Table 3 is CenterPoint Oklahoma's PY 2021 CIP Portfolio with total number of eligible customers and distinct customer totals by program with percentage analysis of district customers who participated and did not participate in the programs

**Table 3: Participation vs. Nonparticipation**

Program	Total Customers	Direct Participants	% Participants	% Nonparticipants
Natural Gas Equipment Program <sup>1</sup>	98,100	884	0.90%	99.10%
Low Flow Showerhead/Aerator <sup>2</sup>	88,787	1,007	1.13%	98.87%
Home Energy Report <sup>2</sup>	88,787	35,418	39.89%	60.11%
High Efficiency Home <sup>2</sup>	88,787	142	0.16%	99.84%
Low Income Saving Homes <sup>2</sup>	88,787	243	0.27%	99.73%
Natural Gas Commercial Solutions Program <sup>3</sup>	10,654	26	0.24%	99.76%
CenterPoint Energy Education Program <sup>4</sup>	99,442	99,739	100%	0%

## 165:45-23-7(c)(4-6): Projected & Actual Energy Savings

**OAC § 165:45-23-7(c)(4):** By Demand Program, approved projected energy savings (in decatherms) as approved;

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<sup>1</sup>Customer class includes RES and GS-1 (Dec. 2021)

<sup>2</sup>Customer class includes residential only (Dec. 2021)

<sup>3</sup>Custom class include GS-1, CS-1, TSO (Dec. 2021)

<sup>4</sup>All rate classes (Dec. 2021)

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**OAC § 165:45-23-7(c)(5): The gross energy savings (in decatherms) and performance of each Demand program; and**

**OAC § 165:45-23-7(c)(6): The verified energy savings (in decatherms) by Demand Program and methods used to verify.**

Table 4 compares the projected savings to the gross and net savings achieved in 2021 for each program.

**Table 4: Projected, Gross, and Net Energy Savings by Program**

Program	2021 Projected Annual Savings (MCF)	2021 Annual Gross Savings Achieved (MCF)	2021 Annual Net Savings Achieved (MCF)
Gas Equipment Program	19,888	16,004	13,296
Low Flow Showerhead/Aerator	3,979	1,664	892
Home Energy Report	48,920	32,087	32,087
High Efficiency Home	2,340	2,087	1,892
Low Income Saving Homes	7,500	6,717	6,717
Natural Gas Commercial Solutions Program	36,181	47,903	47,163
CenterPoint Energy Education Program	NA	0	NA
Total	118,807	106,462	102,047

### **Energy Savings and Methodology**

The energy savings methodologies and inputs outlined in the Arkansas Technical Reference Manual (TRM) were used to calculate energy savings for all programs resulting in energy savings. The TRM can be found on the Arkansas Public Service Commission's website.<sup>2</sup> All the weather zones in CenterPoint Oklahoma's service territory are included in the TRM, so any climate differences between the two states have been appropriately considered.

CenterPoint Oklahoma also modified the data and methodologies provided in the Arkansas TRM to calculate energy savings from fuel switching activities. The energy savings utilized in electric to gas applications consider the full fuel cycle of energy and account for the source of the fuel in

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<sup>2</sup> [http://www.apservices.info/EFilings/Docket\\_Search\\_Documents.asp?Docket=10-100-R&DocNumVal=199](http://www.apservices.info/EFilings/Docket_Search_Documents.asp?Docket=10-100-R&DocNumVal=199)

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addition to the site emissions. The Arkansas TRM was used to calculate site and baseline emissions. For heating systems, the electric baseline was an air source heat pump (HSPF 8.2) with back-up electric resistance heating used for 11% of the heating load. For water heating systems, the standard electric water heater efficiencies were utilized.

In PY 2021, ADM Associates (ADM) conducted the Evaluation, Measurement, and Verification (EM&V) of CenterPoint Oklahoma's CIP Portfolio. ADM's review included a process evaluation and an impact evaluation to determine the verified and net savings attributable to the Company's PY 2021 program activities. The 2021 EM&V Report completed by ADM can be found in Appendix A of this report.

### **§ 165:45-23-7(c)(7): Education Programs**

**OAC § 165:45-23-7(c)(7): For Education Programs measurements of outreach efforts, including pre-program and post-program results and copies of evaluations, surveys, focus group results, and other measurement techniques used to gauge the effectiveness of education efforts.**

As part of their PY 2021 EM&V effort, ADM conducted participant surveys to determine how customers became aware of the Company's programs. These survey results are provided in ADM's EM&V Report, and they provide insights on which outreach efforts were the most effective at creating program awareness.

### **§ 165:45-23-7(c)(8): Levelized Cost**

**OAC § 165:45-23-7(c)(8): The levelized cost per decatherm for the Demand Portfolio, Demand Programs, and by customer sector, including all assumptions used to make the calculation.**

The levelized cost for the Company's PY 2021 CIP Portfolio was \$4.44 per Mcf. This is an increase of \$0.89 cents from PY 2020. CenterPoint Oklahoma used the following methodology to calculate the levelized cost:

***Levelized TRC Cost =***

$$\frac{\text{Capital Recovery Factor} * (\text{Total Program Administrator Costs} + \text{Total Participant Costs (net of incentives)})}{\text{Annual Energy Savings (MCF)}}$$

***Where:***

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$$\text{Capital Recovery Factor} = [A * (1 + A)^{(B)}] / [(1 + A)^{(B)} - 1]$$

$A$  = Discount Rate (Societal Rate)

$B$  = Weighted Average Life of Savings

Tables 5 and 6 provide details on the levelized cost at the program, customer sector, and portfolio levels.

**Table 5: Levelized Cost by Program**

Total Resource Cost Test and TRC Levelized Cost By Program		Net Energy Savings	Total Resource Cost Test (TRC)		
		Annual Net Energy Savings	Total Net Benefits	TRC	TRC Levelized Cost
Program	Savings Type	MCF	\$	Ratio	(\$/MCF)
Natural Gas Equipment - Residential	Natural Gas	7,120	\$27,168	0.97	\$6.23
Natural Gas Equipment - Residential	Electric to Gas Fuel Switch	3,682	(\$43,575)	1.34	\$4.07
Natural Gas Equipment - GS-1	Natural Gas	1,324	(\$3,638)	0.82	\$7.43
Natural Gas Equipment - GS-1	Electric to Gas Fuel Switch	1,170	\$62,364	11.57	\$0.53
Natural Gas Equipment - CS-1	Natural Gas	0	\$0	0	NA
Natural Gas Equipment - CS-1	Electric to Gas Fuel Switch	0	\$0	0	NA
<b>Natural Gas Equipment - Total</b>		<b>13,296</b>	<b>\$42,319</b>	<b>1.16</b>	<b>\$5.30</b>
Natural Gas Commercial Solutions - GS-1	Natural Gas	9,804	\$396,854	12.22	\$0.48
Natural Gas Commercial Solutions - CS-1	Natural Gas	26,484	\$963,112	0.75	\$7.57
Natural Gas Commercial Solutions - LCS-1	Natural Gas	10,875	\$388,506	3.26	\$1.75
<b>Natural Gas Commercial Solutions - Total</b>		<b>47,163</b>	<b>\$1,748,472</b>	<b>1.22</b>	<b>\$4.68</b>
<b>Low Flow Showerhead/Aerator</b>	<b>Natural Gas</b>	<b>892</b>	<b>(\$46,031)</b>	<b>0.60</b>	<b>\$8.18</b>
<b>Residential Home Energy Reports</b>	<b>Natural Gas</b>	<b>32,087</b>	<b>(\$66,571)</b>	<b>0.66</b>	<b>\$6.19</b>
<b>High Efficiency Homes</b>	<b>Natural Gas</b>	<b>1,892</b>	<b>(\$56,728)</b>	<b>0.78</b>	<b>\$7.81</b>
<b>Low Income Savings Homes</b>	<b>Natural Gas</b>	<b>6,717</b>	<b>\$71,489</b>	<b>9.98</b>	<b>\$0.56</b>
CenterPoint Energy Education Program - Res	Educational Program	0	(\$35,788)	0	NA
CenterPoint Energy Education Program - GS-1	Educational Program	0	(\$5,890)	0	NA
CenterPoint Energy Education Program - CS-1	Educational Program	0	(\$8,640)	0	NA
CenterPoint Energy Education Program - LCS	Educational Program	0	(\$3,867)	0	NA
<b>CenterPoint Energy Education Program Total</b>	<b>Educational Program</b>	<b>0</b>	<b>(\$54,185)</b>	<b>0</b>	<b>NA</b>
<b>Total Portfolio</b>		<b>102,047</b>	<b>\$1,638,765</b>	<b>1.23</b>	<b>\$4.44</b>

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**Table 6: Levelized Cost by Customer Sector**

Total Resource Cost Test and TRC Levelized Cost By Customer Sector	Net Energy Savings	Total Resource Cost Test (TRC)		
	Energy Savings	Total Net Benefits	TRC	Levelized Cost
Customer Sector	MCF	\$	Ratio	\$/MCF
Residential	52,390	\$ (150,036)	1.23	\$ 4.26
Commercial GS-1	12,298	\$ 449,690	4.48	\$ 1.31
Commercial CS-1	26,484	\$ 954,471	0.75	\$ 7.59
Commercial LCS	10,875	\$ 384,639	3.21	\$ 1.77
<b>Total Portfolio</b>	<b>102,047</b>	<b>\$ 1,638,764</b>	<b>1.23</b>	<b>\$ 4.44</b>

## § 165:45-23-7(c)(9): Reduced Emissions and Water Consumption

**OAC § 165:45-23-7(c)(9):** The amount of reduced emissions and water consumption experienced by the utility, including all assumptions and calculation details, during the Demand Program period for the current program year.

### Reduced Emissions

CenterPoint Oklahoma utilized the United States Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator<sup>3</sup> to estimate the impact of reduced emissions attributable to the 102,047 in Mcf savings delivered through the PY 2021 CIP Portfolio. Overall, the Company's programs reduced carbon dioxide (CO<sub>2</sub>) emissions by 5,621 metric tons. This is equivalent to:

Greenhouse gas emissions from:

- 1,211 passenger vehicles driven for one year; or
- 13,952,215 miles driven by an average passenger vehicle.

Carbon dioxide emissions from:

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<sup>3</sup> [epa.gov/energy/greenhouse-gas-equivalencies-calculator?unit=MCF&amount=102,507](https://epa.gov/energy/greenhouse-gas-equivalencies-calculator?unit=MCF&amount=102,507)

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- Annual energy use of 708 homes;
- 6,219,009 pounds of coal burned; or
- 632,485 gallons of gasoline consumed.

**Reduced Water Consumption**

Table 7 CenterPoint Oklahoma calculated the reduction in water consumption delivered through the Low-Flow Showerhead and Faucet Aerator Program. Based on the count, by weather zone, of each low-flow equipment type, an estimated annual reduction in gallons of water use was calculated.

**Table 7: Reduced Water Consumption**

<b>Annual Water Savings Low Flow Showerhead And Faucet Aerator Program</b>			
Measure	Equipment Count	Gross Water Savings (Gallons)	Net Water Savings (Gallons)
Bathroom Aerator	839	429,690	216,134
Kitchen Aerator	654	155,428	78,180
Showerhead	1,703	208,923	105,088
Total	3,196	794,041	399,403

**§ 165:45-23-7(c)(10): Portfolio Budget & Total Annual Gas Revenue**

**OAC § 165:45-23-7(c)(10): The Demand Portfolio funding as a percent of total annual gas revenue**

Table 8 displays the PY 2021 CIP Portfolio budget as a percentage of CenterPoint Oklahoma's 2021 revenue.

**Table 8: Demand Portfolio Funding as a Percent of Total Annual Gas Revenue**

<b>2021 Net Energy Savings (MCF)</b>	<b>2021 Natural Gas Usage (MCF)</b>	<b>Energy Savings %Annual Gas Usage</b>
102,047	7,829,122	1.30%

**§ 165:45-23-7(c)(11): Portfolio Energy Savings & Annual Gas Usage**

**OAC § 165:45-23-7(c)(11): The Demand Portfolio Net source energy savings as a percent of total gas annual usage**

Table 9 displays the PY 2021 CIP Portfolio net energy savings as a percentage of CenterPoint Oklahoma's 2021 natural gas throughput.

**Table 9: Demand Portfolio Savings as a Percent of Total Natural Gas Usage**

<b>2021 Portfolio Budget</b>	<b>2021 Revenue</b>	<b>Demand Portfolio Funding % Total Revenue</b>
2,454,977	80,549,962	3.05%

**§ 165:45-23-7(c)(12): Projected Program Costs**

**OAC § 165:45-23-7(c)(12): The projected program costs;**

**These costs should be separated into the following categories to allow review of spending:**

- (i) Administrative costs;
- (ii) Inducements: direct payments and other inducements
- (iii) Educations and marketing costs;
- (iv) Program delivery costs; and
- (v) EM&V costs



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Table 10 provides the PY 2021 budgets for each program by cost category.

**Table 10: Program Budgets by Category**

Program	Delivery	Evaluation	Admin	Education/ Advertising	Inducements	Total Program
Gas Equipment Program	\$133,900	\$35,000	\$20,600	\$61,800	\$900,450	\$1,151,750
Low Flow Showerhead and Faucet Aerator	\$56,395	\$3,947	\$6,180	\$25,750	\$20,713	\$112,985
Residential Home Energy Reports	\$187,368	\$1,236	\$4,120	\$0	\$0	\$192,724
High Efficiency Homes Program	\$19,046	\$2,500	\$6,180	\$5,150	\$105,000	\$137,876
Low Income Savings Homes	\$41,200	\$10,300	\$10,300	\$15,450	\$150,000	\$227,250
Natural Gas Commercial Solutions	\$154,500	\$25,016	\$15,450	\$41,200	\$318,976	\$555,142
CenterPoint Energy Education Program	\$0	\$0	\$0	\$77,250	\$0	\$77,250
Total Program Costs	<b>\$592,409</b>	<b>\$77,999</b>	<b>\$62,830</b>	<b>\$226,600</b>	<b>\$1,495,139</b>	<b>\$2,454,977</b>

**§ 165:45-23-7(c)(13): Actual Program Costs**

**OAC § 165:45-23-7(c)(13): The projected program costs;**

**These costs should be separated into the following categories to allow review of spending:**

- (i) Administrative costs;
- (ii) Inducements: direct payments and other inducements
- (iii) Educations and marketing costs;
- (iv) Program delivery costs; and
- (v) EM&V costs

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Table 11 provides the actual PY 2021 expenditures for each program by cost category.

**Table 11: Program Spending by Category**

Program	Admin.	Inducements	Education/ Advertising	Delivery	Evaluation	Total Program
Gas Equipment Program	\$17,036	\$498,840	\$29,778	\$120,396	\$17,094	\$683,144
Low Flow Showerhead and Faucet Aerator	\$5,111	\$12,863	\$16,347	\$41,990	\$246	\$76,557
Residential Home Energy Reports	\$3,407	\$720	\$0	\$189,686	\$605	\$194,418
High Efficiency Homes Program	\$5,111	\$142,060	\$2,954	\$16,136	\$798	\$167,058
Low Income Savings Homes	\$8,518	\$200,769	\$0	\$34,072	\$2,991	\$246,351
Natural Gas Commercial Solutions	\$12,777	\$343,773	\$24,234	\$294,273	\$12,433	\$687,490
CenterPoint Energy Education Program	\$0	\$0	\$54,186	\$0	\$0	\$54,186
<b>Total Program Costs</b>	<b>\$51,960</b>	<b>\$1,199,025</b>	<b>\$127,498</b>	<b>\$696,554</b>	<b>\$34,166</b>	<b>\$2,109,203</b>

## **§ 165:45-23-7(c)(14-15): Incentives**

**OAC § 165:45-23-7(c)(14): Projected incentives – including projected cost effectiveness tests;**

**OAC § 165:45-23-7(c)(15): Actual calculated incentives – including workpapers and working spreadsheets (formulas, calculations, linkages, and assumptions) or for updated cost effectiveness tests, in sufficient detail to allow review of cost effectiveness calculations**

CenterPoint Oklahoma’s calculated incentive is \$211,137 based on the results of its PY 2021 CIP Portfolio. Pursuant to OAC § 165:45-23-8, eligibility to receive an incentive requires that the Company’s Demand Portfolio reach a goal ratio (Verified savings divided by Projected Savings) of at least 80% and achieve a total resource cost test benefit/cost ratio of greater than one. For PY 2021, the Company is eligible for an incentive because CenterPoint Oklahoma’s CIP portfolio goal ratio was 86% and it achieved a cost/benefit ratio of 1.23.

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Table 12 provides the calculation for the requested 2021 CIP Portfolio incentive.

**Table 12: Incentive Calculation**

<b>Table 12: Incentive Calculation</b>		
<b>Line No.</b>	<b>Incentive Calculation Input</b>	
1	Projected Energy Savings (MCF)	118,807
2	Actual Portfolio Energy Savings (MCF)	102,047
3	Program Expenditure	\$ 2,109,203
4	TRC Ratio	1.23
5	Portfolio Net Benefits	\$ 1,638,764
6	Maximum Incentive, Percentage Net Benefits	15%
7	Goal Ratio (Line 2/Line 1)	85.89%
8	Maximum Eligible Incentive \$ (Line 5 X Line 6 X Line 7)	\$ 211,137
9	Incentive Cap Percentage Portfolio Expenditure	8%
10	Incentive Cap (Line 3 X Line 9)	\$ 316,380
11	2021 Incentive	\$ 211,137

## **§ 165:45-23-7(c)(16): Utility growth or reduction**

**OAC § 165:45-23-7(c)(16):** The utility’s annual growth or reduction in metered natural gas for the previous three years, with a calculation of the average growth or reduction rate over that entire period.

CenterPoint Oklahoma’s metered sales volumes are provided by customer class in Table 13.

**Table 13: Metered Sales Volumes (CCF) per Customer Class**

<b>Customer Class</b>	<b>2017</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>Average Rate of Change Per Year</b>
Residential	41,224,824	53,639,082	54,106,960	47,029,340	48,894,439	-4.94%
Commercial GS-1	12,892,967	13,715,340	11,860,902	9,443,865	10,992,565	-3.73%
Commercial CS-1	19,799,411	17,254,304	19,685,831	21,830,008	17,016,011	-7.03%
TSO	19,799,411	50,120,091	51,583,016	47,980,262	51,502,349	-0.08%

## **§ 165:45-23-7(c)(17): Market Conditions**

**§ 165:45-23-7(c)(17):** The most current information available comparing the base line and milestones to be achieved under market transformation programs with actual conditions in the market.

PY 2021 marked the second year of CenterPoint Oklahoma’s updated CIP Portfolio. It remains important for the Company to evaluate market conditions to improve program performance in PY 2021 - 2022, as well as plan for the PY 2023 - 2025 CIP Portfolio.

In PY 2017, the Company combined its prescriptive rebates for space heating and water heating equipment into one program offering called the Natural Gas Equipment Program. As previously discussed, demand for fuel-switching inducements remained high, and these rebates continue to be an effective tool to influence the purchase and installation of efficient natural gas equipment. Regardless of whether the inducements were for fuel-switching or standard natural gas to natural gas retrofits, most of the program participants chose the highest efficiency option. In most cases, customers who received inducements for natural gas furnaces elected 95% or greater AFUE

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models rather than 90%-94.9% AFUE models, and the majority of water heating inducements were for tankless water heaters. In PY 2021 the clothes dryer, cooking range, and multifamily programs were consolidated into the gas equipment program as measures. These programs historically underperformed or experienced market volatility due to the rural nature of the Company's service territory. CenterPoint Oklahoma considered discontinuing the programs but decided to add them to the Natural Gas Equipment Program as value added measures to maintain comprehensiveness and support our customer attrition mitigation initiative.

The Low-Flow Program continued to see declines in participation due to the maturity of the program. The primary factor for savings reductions was lower installation rates, which were identified by our evaluator, ADM, during their program survey process. To improve participation, self-install thermostats were added as a means to offer a new measure that could drive traffic to the website. Additional measures will be introduced to refresh program offerings for PY 2022 as marketing efforts alone to drive traffic to the website produced mixed results. Additional efforts will also be made to ensure installation rates improve.

The Low-Income Saving Homes Program ("LISHP") is a program implemented by a third-party vendor in partnership with Public Service Company of Oklahoma ("PSO"). The LISHP is well received by CenterPoint Oklahoma customers, and the Company will be looking to build on its success. As such, we increased the budget for the program to serve more eligible natural gas customers.

The Home Energy Reports Program continues to see solid participation, however, savings experienced a decline this year. The program helps customers create habits that reduce energy consumption. Cross-platform marketing also helps promote energy savings in other programs. The promotion of other programs typically come in the form of direct mail and digital interactions. An increase in customer engagement is planned to increase natural gas savings.

The Natural Gas Commercial Solutions Program again proved to be a high performing program and delivered a substantial portion of the CIP Portfolio's energy savings and net economic benefits. Projects by C&I Program participants yielded 47,163 Mcf in energy savings for PY 2021.

### **§ 165:45-23-7(c)(18): Summary of Spending by Demand Program**

**OAC § 165:45-23-7(c)(18): By Demand Program, provide a summary of spending, including the following:**

(A) Administrative Costs;

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- (B) Inducements, including direct payments and other inducements;
- (C) Education and marketing costs;
- (D) Program Delivery Costs; and
- (E) EM&V Costs.

Table 14 provides the actual 2021 program expenditures by Demand Program and cost category.

**Table 14: 2021 Program Spending by Category**

Program	Admin.	Inducements	Education/ Advertising	Delivery	Evaluation	Total Program
Gas Equipment Program	\$17,036	\$498,840	\$29,778	\$120,396	\$17,094	\$683,144
Low Flow Showerhead and Faucet Aerator	\$5,111	\$12,863	\$16,347	\$41,990	\$246	\$76,557
Residential Home Energy Reports	\$3,407	\$720	\$0	\$189,686	\$605	\$194,418
High Efficiency Homes Program	\$5,111	\$142,060	\$2,954	\$16,136	\$798	\$167,058
Low Income Savings Homes	\$8,518	\$200,769	\$0	\$34,072	\$2,991	\$246,351
Natural Gas Commercial Solutions	\$12,777	\$343,773	\$24,234	\$294,273	\$12,433	\$687,490
CenterPoint Energy Education Program	\$0	\$0	\$54,186	\$0	\$0	\$54,186
<b>Total Program Costs</b>	<b>\$51,960</b>	<b>\$1,199,025</b>	<b>\$127,498</b>	<b>\$696,554</b>	<b>\$34,166</b>	<b>\$2,109,203</b>

## § 165:45-23-7(c)(19): Funds Planned versus Funds Expended

**§ 165:45-23-7(c)(19): A statement of any funds that were committed but not spent during the year, by program, with an explanation for non-spending.**

CenterPoint Oklahoma's PY 2021 CIP Portfolio expenses were \$2,109,203, which is 86% of the approved budget of \$2,454,977.

Program	Comment
Natural Gas Equipment Program	The program reached 59% of the planned budget with final expenses reaching \$683,144, which is a slight decrease over last year's program spend. Expense management in the form of reduced labor charges and travel restrictions helped keep program spend to a minimum.

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Low Flow Shower Aerator Program	The program expenses reached 68% of the planned budget. The program was heavily marketed, however, the program continues to see declining participation mainly due to market saturation. The program will get an update with new measures being introduced to improve participation.
CenterPoint Energy Education Program	The program had a typical year reaching 70% of the planned budget. Educating customers and promoting the Company's CIP program continues to be a major part of our program as it reaches the most customers. Lower spend is due to leveraging more cost-effective ways to promote programs.

**Table 15: Budgeted Funding and Actual Expenditures by Program**

Program	Program Funds Budgeted	Program Funds Expended	% Budget Spent
Gas Equipment Program	\$1,151,750.00	\$683,143.92	<b>59%</b>
Low Flow Showerhead and Faucet Aerator	\$112,985.00	\$76,556.57	<b>68%</b>
Residential Home Energy Reports	\$192,724.00	\$194,418.08	<b>101%</b>
High Efficiency Homes Program	\$137,876.19	\$167,058.14	<b>121%</b>
Low Income Savings Homes	\$227,250.00	\$246,350.56	<b>108%</b>
Natural Gas Commercial Solutions	\$555,142.02	\$687,489.69	<b>124%</b>
CenterPoint Energy Education Program	\$77,250.00	\$54,185.64	<b>70%</b>
<b>Total Program Costs</b>	<b>\$2,454,977</b>	<b>\$2,109,203</b>	<b>86%</b>

**§ 165:45-23-7(c)(20): Description of Each Demand Program**

**§ 165:45-23-7(c)(20): A detailed description of each Demand Program reflecting the scale of the program as part of the Demand Portfolio that includes the following:**

- (A) Number of customers served by each Demand Program or program category;
- (B) Program or program category expenditures;
- (C) Verified energy and peak demand savings achieved by the Demand Program or program category, when available; and
- (D) A description of proposed changes in the Demand Program plans.



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Detailed information related to 2021 expenditures, participation, energy savings, overall program scale, as well as recent or proposed changes is provided below for each program:

## Natural Gas Equipment Program



The Natural Gas Equipment program is designed to promote efficient water heating and space heating solutions to residential and commercial consumers. Rebates are offered to consumers for high-efficiency furnaces, water heaters, clothes dryers, cooking ranges, and smart thermostats.

CenterPoint Oklahoma does not propose any major changes to the program currently.

### Participation & Energy Savings

Customer Class	Participation	Gross Energy Savings (MCF)	% Portfolio Gross Savings	Net Energy Savings (MCF)	% Portfolio Net Savings
<b>Residential</b>	781	12,793	12.02%	10,802	10.59%
<b>GS-1</b>	103	3,211	3.02%	2,494	2.44%
<b>CS-1</b>	0	0	0.00%	0	0.00%
<b>Total</b>	884	16,004	15.03%	13,296	13.03%

### Program Expenditures

Customer Class	Admin	Inducement	Marketing	Delivery	EM&V	Total Program	% Total Portfolio
<b>Residential</b>	\$14,873	\$435,507	\$25,998	\$105,110	\$14,924	\$596,412	28.3%
<b>GS-1</b>	\$2,163	\$63,333	\$3,781	\$15,285	\$2,170	\$86,732	4.1%
<b>CS-1</b>	\$0	\$0	\$0	\$0	\$0	\$0	0.0%
<b>Total</b>	\$17,036	\$498,840	\$29,778	\$120,396	\$17,094	\$683,143.92	32.4%

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## Low-Flow Program



The Low-Flow Showerhead and Faucet Aerator Program provides customers with no-cost showerheads and faucet aerators that conserve water and reduce energy usage. Customers can order equipment through an online shopping cart, and the requested number of low-flow units are mailed, along with comprehensive installation directions.

CenterPoint Oklahoma does not propose any major changes to the program at this time.

### Participation & Energy Savings

Customer Class	Participation	Gross Energy Savings (MCF)	% Portfolio Gross Savings	Net Energy Savings (MCF)	% Portfolio Net Savings
<b>Residential</b>	1,007	1,664	1.56%	892	0.87%

### Program Expenditures

Customer Class	Admin	Inducement	Marketing	Delivery	EM&V	Total Program	% Total Portfolio
<b>Residential</b>	\$5,111	\$12,863	\$16,347	\$41,990	\$246	\$76,556.57	3.6%

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## Home Energy Report



The Home Energy Reporting Program is a behavioral program that combines energy usage data with customer demographic, housing and GIS data to develop specific, targeted recommendations that educate and motivate consumers to reduce their energy consumption. Program participants receive this information through direct-mail and email reports.

CenterPoint Oklahoma continues to implement the Residential Home Energy Reports Program in its 2021 CIP Portfolio, and no major changes to the program are proposed at this time.

### Participation & Energy Savings

Customer Class	Participation	Gross Energy Savings (MCF)	% Portfolio Gross Savings	Net Energy Savings (MCF)	% Portfolio Net Savings
Residential	35,418	32,087	30.14%	32,087	31.44%

### Program Expenditures

Customer Class	Admin	Inducement	Marketing	Delivery	EM&V	Total Program	% Total Portfolio
Residential	\$3,407	\$720	\$0	\$189,686	\$605	\$194,418.08	9.2%

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## High Efficiency Homes Program



The High Efficiency Home Program provides inducements to encourage builders to construct new homes that are equipped with efficient natural gas appliances. Builders or homeowners are eligible to receive a \$1,000 rebate for new homes equipped with a primary heat source of 95% AFUE natural gas furnace, natural gas water heating, and at least one additional natural gas appliance.

The Company does not propose any program changes at this time.

### Participation & Energy Savings

Customer Class	Participation	Gross Energy Savings (MCF)	% Portfolio Gross Savings	Net Energy Savings (MCF)	% Portfolio Net Savings
Residential	142	2,087	1.96%	1,892	1.85%

### Program Expenditures

Customer Class	Admin	Inducement	Marketing	Delivery	EM&V	Total Program	% Total Portfolio
Residential	\$5,111	\$142,060	\$2,954	\$16,136	\$798	\$167,058.14	7.9%

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## Low-Income Saving Homes Program



Provides weatherization retrofits that will improve the efficiency and comfort of CenterPoint Oklahoma's low-income and hard to reach residential customers.

CenterPoint Oklahoma does not propose any major changes to the program at this time.

### Participation & Energy Savings

Customer Class	Participation	Gross Energy Savings (MCF)	% Portfolio Gross Savings	Net Energy Savings (MCF)	% Portfolio Net Savings
Residential	243	6,717	6.31%	6,717	6.58%

### Program Expenditures

Customer Class	Admin	Inducement	Marketing	Delivery	EM&V	Total Program	% Total Portfolio
Residential	\$8,518	\$200,769	\$0	\$34,072	\$2,991	\$246,350.56	11.7%

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## Natural Gas Commercial Solutions Program



The Natural Gas Commercial Solutions Program encourages Commercial and Industrial (C&I) customers to use natural gas efficiently by installing cost-effective energy efficient equipment, adopting energy-efficient designs, and using energy-efficient operations at their facilities. The program provides financial incentives to C&I customers installing or implementing cost-effective energy efficiency measures through the Direct-Install, Custom, or Prescriptive measure components of the program.

The Company does not propose any major changes to the program at this time.

### Participation & Energy Savings

Customer Class	Participation	Gross Energy Savings (MCF)	% Portfolio Gross Savings	Net Energy Savings (MCF)	% Portfolio Net Savings
<b>GS-1</b>	2,497	10,019	9.41%	9,804	9.61%
<b>CS-1</b>	3,156	27,009	25.37%	26,484	25.95%
<b>LCS - TSO</b>	2	10,875	10.21%	10,875	10.66%
<b>Total</b>	5,655	47,903	45.00%	47,163	46.22%

### Program Expenditures

Customer Class	Admin	Inducement	Marketing	Delivery	EM&V	Total Program	% Total Portfolio
<b>GS-1</b>	\$2,491	\$67,012	\$4,724	\$57,363	\$2,423	\$134,012.99	6.4%
<b>CS-1</b>	\$7,106	\$191,196	\$13,478	\$163,666	\$6,915	\$382,360.14	18.1%
<b>LCS - TSO</b>	\$3,180	\$85,565	\$6,032	\$73,245	\$3,094	\$171,116.57	8.1%
<b>Total</b>	\$12,777	\$343,773	\$24,234	\$294,273	\$12,433	\$687,489.69	32.6%

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## CenterPoint Energy Education Program (CEEP)



CEEP is an education and awareness program that has no directly attributable energy savings associated with program implementation.

CenterPoint Oklahoma continues to implement the CEEP in its 2021 CIP Portfolio and does not propose any major changes to the program at this time.

### Program Expenditures

Customer Class	Admin	Inducement	Marketing	Delivery	EM&V	Total Program	% Total Portfolio
<b>Residential</b>	\$0	\$0	\$35,788	\$0	\$0	\$35,787.95	1.7%
<b>GS-1</b>	\$0	\$0	\$5,890	\$0	\$0	\$5,890.46	0.3%
<b>CS-1</b>	\$0	\$0	\$8,640	\$0	\$0	\$8,640.41	0.4%
<b>LCS</b>	\$0	\$0	\$3,867	\$0	\$0	\$3,866.82	0.2%
<b>Total</b>	\$0	\$0	\$54,186	\$0	\$0	\$54,185.64	2.6%

## **§ 165:45-23-7(b)(21): Research and Development Activities**

**§ 165:45-23-7(c)(21): A list of research and development activities included in the demand portfolio, their status, and a report on the connection between each activity and effective energy efficiency programs.**

CenterPoint Oklahoma did not conduct any research and development activities during PY 2021.

## **§ 165:45-23-7(c)(22): Program Implementers**

**§165:45-23-7(c)(22): Identification of program implementers, including names, job titles, business postal addresses, business electronic mail addresses, and business telephone numbers.**

CenterPoint Oklahoma implements the following programs in-house: CEEP, Low-Flow Showerhead Program, and Natural Gas Equipment Program. Remainder of the programs are vendor implemented.

The contact information is:

Name of Program Implementer: Jose Laboy

Job Title: CIP Implementation Manager

Business Postal Address: 1400 Centerview Drive, Suite 100, Little Rock, AR 72211

Business Email Address: [jose.laboy@centerpointenergy.com](mailto:jose.laboy@centerpointenergy.com), [jlabor@summitutilities.com](mailto:jlabor@summitutilities.com)

Business Telephone Number: 501-377-4837

The Home Energy Reports program is implemented by Oracle Utilities (formerly Opower Inc.) with oversight and management by CenterPoint Oklahoma. The CenterPoint Oklahoma contact is as above and the Oracle contact is:

Name of Program Implementer: Rick Suber

Job Title: Service Delivery Manager



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Business Postal Address: 2311 Wilson Blvd., 8<sup>th</sup> Floor, Arlington, VA 22201

Business Email Address: rick.suber@oracle.com

Business Telephone Number: 202-615-2094

CenterPoint Oklahoma manages the Low Flow Showerhead and Faucet Aerator program, but it utilizes the fulfillment services of Energy Federation, Inc. (EFI). The CenterPoint Oklahoma contact is as above and the EFI contact is:

Name of Program Implementer: Tyler Bartlett-Browne

Job Title: Strategic Account Manager

Business Postal Address: 2031 Progress Way, Kaukauna, WI 54130

Business Email Address: tbartlett-browne@efi.org

Business Telephone Number: 508-870-2277

The Low-Income Saving Homes Program is delivered by our vendor Titan ES, in partnership with Public Service Company of Oklahoma (“PSO”). The Titan ES contact is:

Name of Program Implementer: Brad Cockings

Job Title: Program Manager

Business Postal Address: 9700 S. Pole Rd. Oklahoma City, OK 73160

Business Email Address: bcockings@titanes.us

Business Telephone Number: 405-632-1700

The Natural Gas Commercial Solutions Program is delivered by our vendor, CLEAResult. The CLEAResult contact is:

Name of Program Implementer: Shelly Baron

Job Title: Program Manager

Business Postal Address: One Allied Dr., Suite 1600, Little Rock, AR 72202

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Business Email Address: shelly.baron@clearesult.com

Business Telephone Number: 501-221-4063

### **Conclusion**

PY 2021 was the second year of the current three-year portfolio plan cycle spanning PY 2020 – 2022. Changes to the portfolio included the consolidation of some underperforming programs and the addition of a low-income weatherization program. These changes have proven to be effective, as the savings for PY 2020 and PY 2021 have increased by an average of 11% when compared to the final year (PY 2019) of the previous three-year portfolio plan. Program year 2021 savings decreased slightly as compared to PY 2020 due primarily to lower savings achieved in the Home Energy Reports Program and Low-Flow Program. COVID-19 variants and challenging economic conditions in 2021 continued to put pressure on labor and the supply chain, which adversely affected the boiler and foodservice market. Long standing relationships with trade allies and supply houses helped mitigate disruptions by working through supply chain issues. Savings from the Low-Flow Program were particularly low due to program maturity. CenterPoint Oklahoma worked with the portfolio evaluator and program implementer to identify additional measures that will increase traffic to the existing marketplace by inducing the customer with new energy savings measures, such as weatherstripping, door sweeps, and filter changeout alarms.

Overall, the Demand Portfolio achieved strong savings for Oklahoma customers, achieving 102,047 MCF in natural gas savings. The low avoided costs filed in the Demand Portfolio for 2020 - 2022 continue to suppress the Program Administrator Cost Test (“PACT”) net benefits as compared to the previous three-year plan cycle. The lower avoided cost will continue to impact the PACT in 2022. Despite this fact, the portfolio remains cost effective, resulting in a TRC ratio of 1.23 and producing \$1.64 million in net benefits to Oklahoma customers. As CenterPoint Oklahoma strives to grow its programs, insights from PY 2021 will help the Company better understand both the strengths of its CIP Portfolio and the aspects that need improvement. The Company remains committed to building on its successes, addressing its challenges, improving its programs, and delivering a high-performing and comprehensive CIP Portfolio.

# **Appendix A – EM&V Report**

# **Evaluation of Summit Oklahoma Program Year 2021 Demand Side Management Portfolio**

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Submitted to:

*Summit Oklahoma*

*April 2021*



ADM Associates, Inc.

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## **Acknowledgements:**

We would like to thank the staff at Summit Oklahoma for their time and effort in contributing to the EM&V of the 2021 programs. This evaluation was conducted with regular coordination with staff at Summit, who provided quick feedback and turnaround to the requests of the evaluation team as well as open and forthright insights into the operations of their programs.

Further, we would like to acknowledge our gratitude towards Summit customers, implementation contractor staff and trade allies. As with the staff at Summit, their active participation allowed for the evaluation team to collect all needed data for this effort.

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# 1. Executive Summary

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This report is to provide a summary of the evaluation effort of the 2021 Demand Side Management (DSM) portfolio by Summit Oklahoma (Summit). ADM Associates (the Evaluators) conducted this evaluation. This report provides verified gross and net savings estimates for evaluated programs.

## 1.1 Summary of Summit Demand Side Management Programs

---

In 2021, the Summit DSM portfolio contained the following programs:

- Natural Gas Equipment Rebates Program;
- High Efficiency Homes Program;
- Commercial and Industrial Solutions Program;
- Home Energy Reports Program;
- Low Income Savings Home Program; and
- Low Flow Showerhead & Faucet Aerator Program.

## 1.2 Evaluation Objectives

---

The goals of the 2021 EM&V effort are as follows:

- For prescriptive measures, verify that savings are being calculated according to appropriate deemed savings protocols.
- For custom measures, this effort comprises the calculation of savings according to accepted protocols (such as IPMVP). This is to ensure that custom measures are cost-effective and providing reliable savings.

## 1.3 Summary of Findings

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### 1.3.1 Impact Findings

Table 1-1 and Table 1-2 present the gross and net impact by program.

*Table 1-1 Gross Impact Summary*

Program	Annual Energy Savings (Therms)		Lifetime Energy Savings (Therms)		Gross Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post	
Natural Gas Equipment Rebates	160,035	160,035	2,490,815	2,518,004	100.0%
High Efficiency Homes	20,874	20,874	413,067	413,067	100.0%
Commercial Solutions	480,587	479,031	6,162,684	6,280,299	99.7%
Home Energy Reports	320,867	320,867	320,867	320,867	100.0%
Low Income Savings Homes	68,733	67,172	1,179,052	1,152,274	97.7%
Low Flow Showerhead & Faucet Aerator	21,075	16,641	210,750	166,410	79.0%
<b>Total</b>	<b>1,072,171</b>	<b>1,064,620</b>	<b>10,777,235</b>	<b>10,850,921</b>	<b>99.3%</b>

Table 1-2 Net Impact Summary

Program	Annual Energy Savings (Therms)		Lifetime Energy Savings (Therms)		NTGR	Net Realization Rate
	Ex Ante	Ex Post	Ex Ante	Ex Post		
Natural Gas Equipment Rebates	132,883	132,962	1,928,877	2,080,712	83.1%	100.1%
High Efficiency Homes	18,920	18,917	374,641	374,603	90.6%	100.0%
Commercial Solutions	473,844	471,630	6,086,197	6,154,034	98.5%	99.5%
Home Energy Reports	320,867	320,867	320,867	320,867	100.0%	100.0%
Low Income Savings Home Program	68,733	67,172	1,179,316	1,152,532	100.0%	97.7%
Low Flow Showerhead & Faucet Aerator	20,295	8,923	202,950	89,230	53.6%	44.0%
<b>Total</b>	<b>1,035,542</b>	<b>1,020,471</b>	<b>10,092,848</b>	<b>10,171,978</b>	<b>95.9%</b>	<b>98.5%</b>

The contribution to portfolio savings by program is summarized in Figure 1-1.

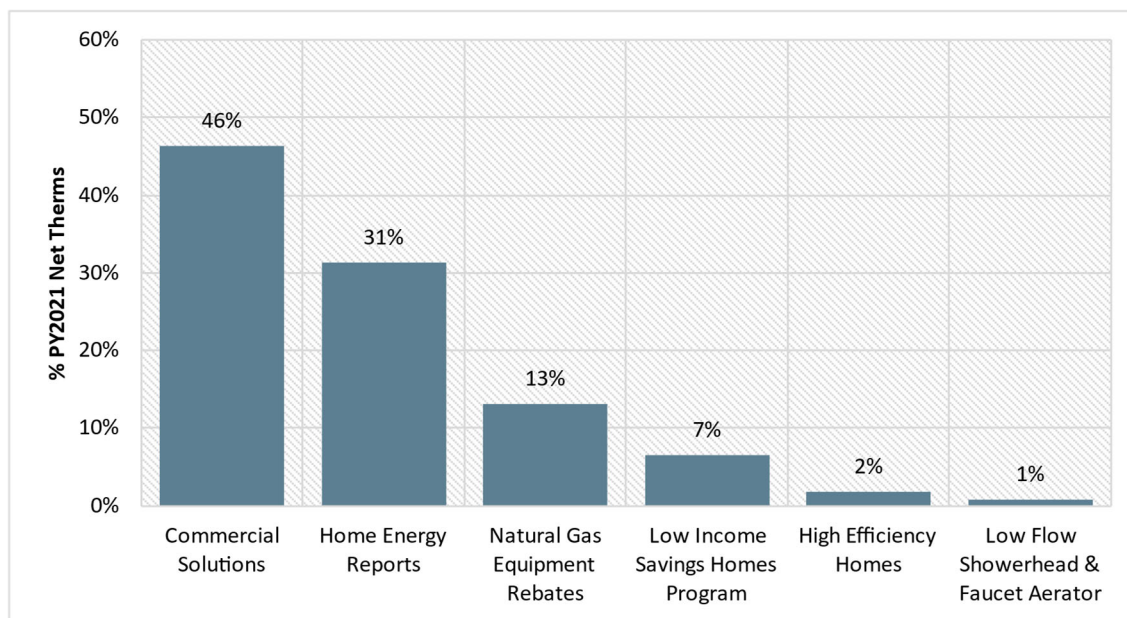


Figure 1-1 Contribution to Portfolio Net Savings by Program

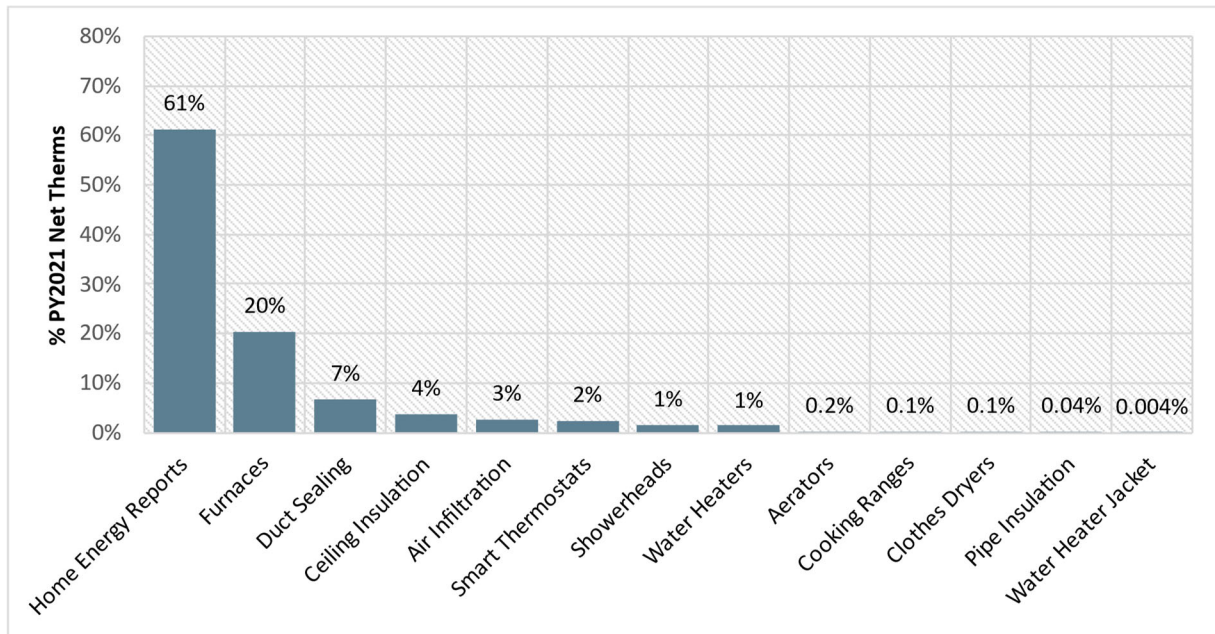
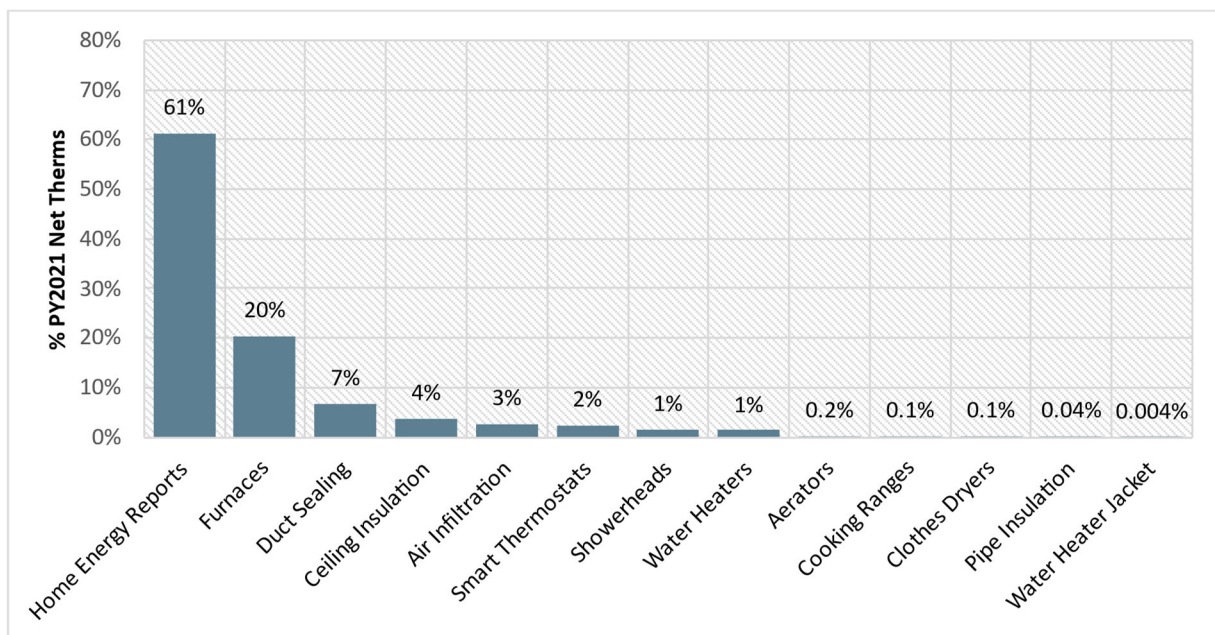
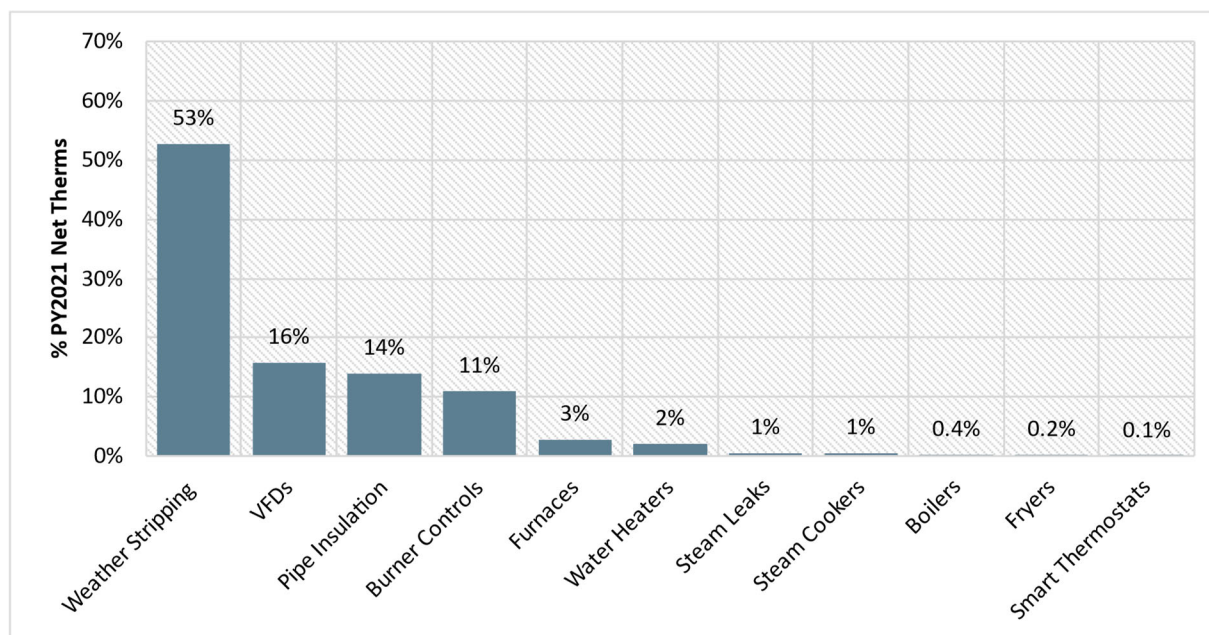


Figure 1-2 and Figure 1-3 summarize the share of savings by measure category for residential and non-residential segments, respectively.



*Figure 1-2 Residential Portfolio Savings Share by Measure**Figure 1-3 C&I Portfolio Savings Share by Measure*

## 1.4 Summary of EM&V Effort

The evaluation effort consisted of:

- **Review of deemed savings calculations.** For all programs that apply deemed savings, the Evaluators conducted a detailed review on a census of projects to ensure that savings are up-to-date with the most recently-available deemed savings and applicable code inputs from the Arkansas Technical Reference Manual v8.2 (AR TRM 8.2).
- **Analysis of custom projects.** Custom projects within the C&I Solutions Program accounted for 20% of portfolio-level savings. All custom projects received site-level analyses based on International Measurement & Verification Protocols (IPMVP).<sup>1</sup>
- **Analysis of bill impacts from Home Energy Reports.** The Home Energy Reports program accounted for 31% of total portfolio savings. The Evaluators conducted an analysis of impacts on customer bills applying methods vetted through the National Renewable

<sup>1</sup> <https://evo-world.org/en/products-services-mainmenu-en/protocols/ipmvp>

Energy Laboratory Uniform Methods Project Chapter 17: Residential Behavioral Protocol.<sup>2</sup>

## 1.5 Report Organization

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This report is organized with one chapter providing the full impact and process summary of a specified program. The report is organized as follows:

- Chapter 2 provides General Methodology;
- Chapter 3 provides results for the Natural Gas Equipment Rebates Program;
- Chapter 4 provides results for the High Efficiency Homes Program;
- Chapter 5 provides results for the Commercial Solutions Program;
- Chapter 6 provides results for the Home Energy Reports Program;
- Chapter 7 provides results for the Low-Income Savings Home Program;
- Chapter 8 provides results for the Low Flow Showerhead and Faucet Aerator Program;
- Appendix A provides the site-level custom reports for the Commercial Solutions Program.

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<sup>2</sup> <https://www.energy.gov/sites/prod/files/2015/02/f19/UMPCChapter17-residential-behavior.pdf>



## 2. General Methodology

---

This section details general impact evaluation methodologies by program-type as well as data collection methods applied. This section will present full descriptions of:

- Gross Savings Estimation;
- Sampling Methodologies;
- Free ridership determination;
- Process Evaluation Methodologies; and
- Data Collection Procedures.

### 1.6 Glossary of Terminology

---

A first step to detailing the evaluation methodologies, the Evaluators provide a glossary of terms to follow:

- *Ex Ante* – Savings estimates provided by program administrators prior to review from a third-party-evaluator (from the Latin for “beforehand”)
- *Ex Post* – Savings estimates reported by an evaluator after the energy impact evaluation has been completed (from the Latin for “From something done afterward”)
- *Deemed Savings* – An estimate of an energy savings or demand savings outcome (gross savings) for a single unit of an installed energy efficiency measure. This estimate (a) has been developed from data sources and analytical methods that are widely accepted for the measure and purpose and (b) are applicable to the situation being evaluated. (e.g., assuming 17.36 Therms savings for a low-flow showerhead)
- *Gross Savings* – The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated.
- *Gross Realization Rate* – Ratio of Ex Post Savings / Ex Ante Savings (e.g., If the Evaluators verify 15 Therms per showerhead, Gross Realization Rate =  $15/17.36 = 86\%$ )
- *Free Rider* – A program participant who *would have* implemented the program measure or practice in the absence of the program. Free riders can be total, partial, or deferred.
- *Spillover* – Reductions in energy consumption and/or demand caused by the presence of the energy efficiency program that exceed the program-related gross savings of the participants. There can be participant and/or non-participant spillover rates depending on the rate at which participants (and non-participants) adopt energy efficiency measures



or take other types of efficiency actions on their own (i.e., without an incentive being offered).

- *Net Savings* – The total change in load that is attributable to an energy efficiency program. This change in load may include, implicitly or explicitly, the effects of free drivers, free riders, energy efficiency standards, changes in the level of energy service, and other causes of changes in energy consumption or demand. (e.g., if Free ridership for low-flow showerheads = 50%, net savings = 15 Therms x (100% - 50%) = 7.5 Therms)
- *Net-to-Gross-Ratio (NTGR)* =  $(1 - \text{Free ridership \%} + \text{Spillover \%})$ , also defined as Net Savings / Gross Savings
- *Ex Ante Net Savings* = Ex Ante Gross Savings x Ex Ante Free Ridership Rate
- *Ex Post Net Savings* = Ex Post Gross Savings x Ex Post Free Ridership Rate
- *Net Realization Rate* = Ex Post Net Savings / Ex Ante Net Savings
- *Effective Useful Life (EUL)* – An estimate of the median number of years that the efficiency measures installed under a program are still in place and operable.
- *Gross Lifetime Therms* = Ex Post Gross Savings x EUL

## 1.7 Overview of Methodology

The proposed methodology for the evaluation of the 2021 Summit DSM Portfolio is intended to provide:

- Net impact results at the 90% confidence and +/-10% precision level; and
- Program feedback and recommendations via process evaluation; and

In doing so, this evaluation will provide the verified net savings results, provide the recommendations for program improvement, and ensure cost-effective use of ratepayer funds. By leveraging experience and lessons learned from prior evaluations, the 2021 evaluation is streamlined to focus on areas in needed of research and improvement.

## 1.8 Sampling

Sampling is necessary to evaluate savings for the Summit DSM portfolio insomuch as verification of a census of program participants is typically cost-prohibitive. Samples are drawn in order to ensure 90% confidence at the +/- 10% precision level. Programs are evaluated on one of three bases:

- Census of all participants
- Simple Random Sample
- Stratified Random Sample

## 1.9 Census of Participants

A census of participant data was used for programs where such review is feasible. For example, the Home Energy Reports program's savings estimates are based on a regression model that incorporates billing data for a census of program recipients. Programs that received analysis of a census of participants include:

- Home Energy Reports;
- Commercial & Industrial Solutions – Custom Component

## 1.10 Simple Random Sampling

For programs with relatively homogenous measures (largely in the residential portfolio), the Evaluators conducted a simple random sample of participants. The sample size for verification surveys is calculated to meet 90% confidence and 10% precision (90/10). The sample size to meet 90/10 requirements is calculated based on the coefficient of variation of savings for program participants. Coefficient of Variation (CV) is defined as:

$$CV(x) = \frac{\text{Standard Deviation}(x)}{\text{Mean}(x)}$$

Where x is the average therms savings per participant. Without data to use as a basis for a higher value, it is typical to apply a CV of .5 in residential program evaluations. The resulting sample size is estimated at:

$$n_0 = \left( \frac{1.645 * CV}{RP} \right)^2$$

Where,

1.645 = Z Score for 90% confidence interval in a normal distribution

CV = Coefficient of Variation

RP = Required Precision, 10% in this evaluation

With 10% required precision (RP), this calls for a sample of 68 for programs with a sufficiently large population. However, in some instances, programs did not have sufficient participation to make a sample of this size cost-effective. In instances of low participation, the Evaluators then applied a finite population correction factor, defined as:

$$n = \frac{n_0}{1 + n_0/N}$$

Where,

$n_0$  = Sample Required for Large Population

$N$  = Size of Population

$n$  = Corrected Sample

For example, if a program were to have 100 participants, the finite population correction would result in a final required sample size of 41. The Evaluators applied finite population correction factors in instances of low participation in determining samples required for surveying or onsite verification. Programs subject to Simple Random Sampling include:

- Heating System Rebates – Residential;
- Water Heating Rebates – Residential;
- Low Flow Showerhead, and Faucet Aerator Program.

### 1.11 Free Ridership

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In determining ex-post net savings for the Summit DSM portfolio, the Evaluators provide estimates of free ridership for individual programs. Free riders are program participants that would have implemented the same energy efficiency measures at nearly the same time absent the program. As per TRM guidelines, free riders are defined as:

“...program participants who received an incentive but would have installed the same efficiency measure on their own had the program not been offered. This includes partial free riders, defined as customers who, at some point, would have installed the measure anyway, but the program persuaded them to install it *sooner* or customers who would have installed the measure anyway, but the program persuaded them to install more efficient equipment and/or more equipment. For the purposes of EM&V activities, participants who would have installed the equipment within one year will be considered full free riders; whereas participants who would have installed the equipment later than one year will not be considered to be free riders (thus no partial free riders will be allowed).”

Given this definition, participants are defined as free riders through a binary scoring mechanism, in being either 0% or 100% free riders.

#### 1.11.1 Prescriptive Free Ridership

The general methodology for evaluating free ridership among prescriptive program participants involved examination of four factors:

- (1) Demonstrated financial ability to purchase high efficiency equipment absent the rebate
- (2) Importance of the rebate in the decision-making process
- (3) Prior planning to purchase high efficiency equipment

#### (4) Importance of the contractor in influencing the decision-making process

In this methodology, Part (1) is essentially a gateway value, in that if a participant does not have the financial ability to purchase energy efficient equipment absent a rebate, the other components of free ridership become moot. As such, if they could not have afforded the high efficiency equipment absent the rebate, free ridership is scored at 0%. If they did have the financial capability, the Evaluators then examine the other three components. The respondent is determined to be a free rider based upon a preponderance of evidence of these three factors; that is, if the respondent's answers indicate free ridership in two or more of these three components, they are considered free riders. Specific questions and modifications to this general methodology are presented in the appropriate program chapters.

For residential programs, free ridership is calculated as the average score determined for the sample of participants surveyed. This value is then applied to the program-level savings to discount savings attributable to free ridership.

##### **1.11.2 Custom Free Ridership**

For custom projects from the Commercial Solutions program, free ridership is assessed on a case-study basis, through which the Evaluators conduct an in-depth interview that includes a battery of questions addressing:

- The timing of learning of the program relative to the timing of the planning of the retrofit;
- The impact the program incentive has on measure payback relative to the stated payback requirements by the respondent;
- Whether the respondent learned of the energy efficiency measure from a program-funded audit; and
- Whether any influence the program had in modifying the project affected savings by greater than 50%.

### 3. Natural Gas Equipment Rebates Program

---

The Natural Gas Equipment Rebates Program provides incentives to customers for high efficiency space and water heating equipment. Eligible measures for this program include:

#### **Residential:**

- \$300 for Gas furnaces with 90%-94.9% AFUE;
- \$500 for Gas furnaces with 95% or higher AFUE;
- \$2,000 for placement of electric heating to gas furnaces with 90%-94.9% AFUE;
- \$2,000 for placement electric heating to gas furnaces with 95% or higher AFUE;
- \$60 for ENERGY STAR qualified smart thermostats;
- \$60 for ENERGY STAR qualified smart thermostats intended to be self-installed;
- \$200 per 100,000 input BTU for larger storage tank water heaters with 88% or greater thermal efficiency;
- \$500 for tankless water heaters with an EF of 0.80 or greater.
- \$900 for replacement of electric water heater with natural gas tankless water heaters with an EF of 0.80 or greater;
- Up to \$300 for replacement of electric to gas cooking ranges; and
- Up to \$450 for replacement of electric to gas clothes dryers.

#### **Non-residential:**

- \$300 for Gas furnaces with 90%-94.9% AFUE;
- \$500 for Gas furnaces with 95% or higher AFUE;
- \$2,000 for replacement of electric heating to gas furnaces with 90%-94.9% AFUE;
- \$2,000 for replacement electric heating to gas furnaces with 95% or higher FUE; and
- \$200 per 100,000 input BTU for larger storage tank water heaters with 88% or greater thermal efficiency;
- \$500 for tankless water heaters with an EF of .80 or greater.
- \$900 for replacement of electric water heater with natural gas tankless water heaters with an EF of .80 or greater.

The program is targeted at the residential and commercial market sectors and offers incentives for both retrofit and new construction applications. The marketing efforts for the space and

water heating equipment were largely directed at plumbing and HVAC contractors; their involvement is seen as crucial, as they are generally a primary source of information for end-use customers when deciding upon a replacement system.

## **1.12 Program Overview**

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The Natural Gas Equipment Rebates Program is part of a reorganization of the Summit portfolio to consolidate smaller programs. This program combines the following former programs:

- Space Heating
- Water Heating
- Clothes Dryers
- Cooking Ranges
- Multi-unit Market Transformation

### **1.12.1 Participation Summary**

#### ***1.12.1.1 Residential Space Heating Participant Summary***

The 2021 Natural Gas Equipment Rebates Program had a total of 413 processed rebates for residential space heating. The rebates comprised of:

- 305 single family replacement rebates;
- 65 furnace fuel switch rebates;
- 32 new construction furnace rebates;
  - 2 furnaces installed in small office building, metered as residential
- 11 multifamily furnace rebates; and
- 48 smart thermostats rebates.

Of the 413 furnace replacements included:

- 404 furnaces exceeding 95% AFUE; and
- 9 furnaces between 90-94.99% AFUE.

#### ***1.12.1.2 Residential Self-Installed Smart Thermostat Participant Summary***

As an additional aspect of the Natural Gas Equipment Rebate Program for 2021, there were a total of 164 stand-alone smart thermostats that were rebated to participants. All the smart thermostat rebates that the program processed were for single-family projects that received \$60 as an incentive for self-installation.

**1.12.1.3 Residential Water Heating Participant Summary**

The 2021 Natural Gas Equipment Rebates Program had a total of 121 processed rebates for residential water heating. The rebates comprised of:

- 98 single family water heater replacement rebates;
- 23 water heater fuel switch rebates;

All of the 121 residential water heater replacements were tankless water heaters.

There were 23 residential water heater fuel switch rebates and 98 single family (residential) water heater retrofit rebates that were awarded through the Water Heater Fuel Switch and Water Heater Rebate project types, respectively.

**1.12.1.4 Appliance Participant Summary**

Appliance participation comprised:

- 23 cooking ranges; and
- 7 clothes dryers.

**1.12.1.5 Commercial Participation Summary**

There were 98 commercial furnaces rebate in 2021:

- 89 furnaces with 95% or greater AFUE; and
- 9 with AFUE of 90-94.99%.

83.7% of commercial rebates were for retrofit projects. 16.3% were for new construction projects. Figure 3-1 summarizes the participation levels by facility type.

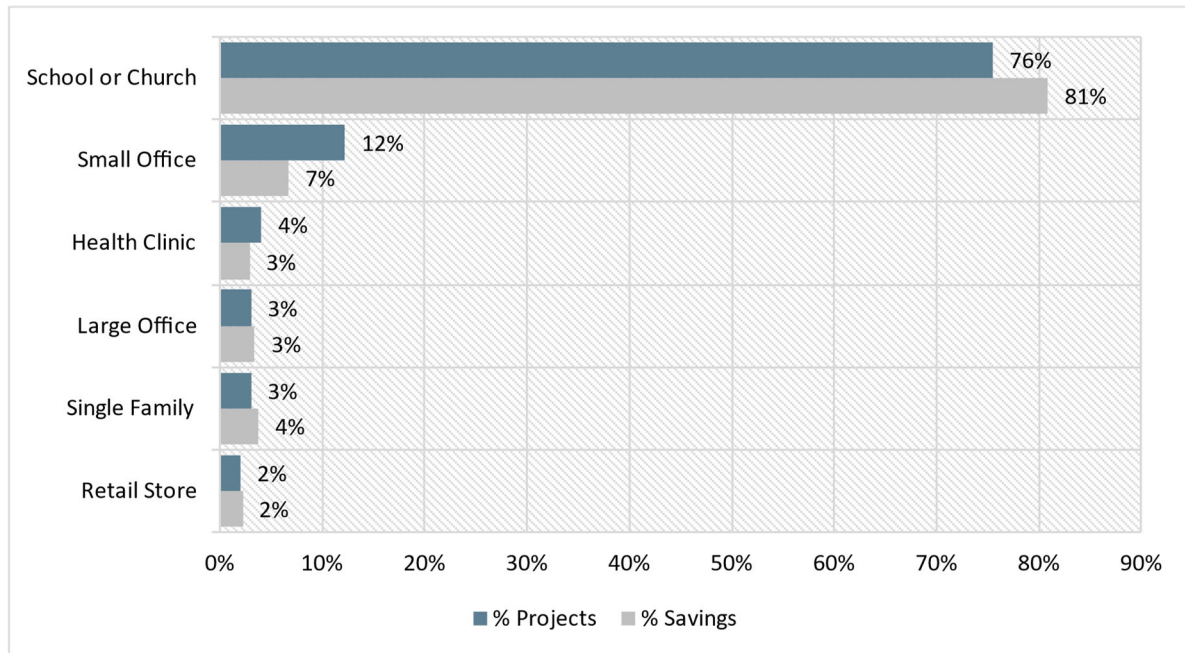


Figure 3-1 Heating System Rebates Commercial Participation by Facility Type

The bulk of participation and savings was driven by schools or churches, small business facilities, and health clinics.

There were five commercial water heaters rebated in 2021:

- (3) conventional retrofits; and
- (2) fuel switch rebates.

### 1.13 Impact Evaluation

#### 1.13.1 Space Heating Energy Savings Calculations

Savings for residential furnaces are calculated as follows:

$$therm_{ex\ post\ savings} = therm_{baseline\ heating\ system} - therm_{new\ heating\ system}$$

First the energy use of the new heating system was found.

$$therm_{new\ heating\ system} = Heat\ load \times \left( \frac{1}{AFUE_{new\ heating\ system}} \right)$$

$$Heat\ load = \left( \frac{therms}{site\ area} \right) \times site\ area = \left( \frac{therms}{yr} \right) \times \left( \frac{CAP_H}{30} \right) \times 1.05$$

Where:



*Site Area = square footage of the project site*

$CAPH = \left(\frac{Btu}{hr}\right)$  = verified heating capacity verified by the Evaluators with AHRI number

*AFUE<sub>new</sub> heating system = verified by the Evaluators with AHRI number*

*Source to site ratio, electric to gas = 3.14*

Next the energy use of the removed water heater was found.

$$therm_{new\ heating\ system} = Heat\ load \times \left(\frac{1}{AFUE_{old\ heating\ system}}\right)$$

$$Heat\ load = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times site\ area = \left(\frac{\frac{therms}{site\ area}}{yr}\right) \times \left(\frac{CAPH}{30}\right) \times 1.05$$

Where:

$$\left(\frac{\frac{therms}{site\ area}}{yr}\right) = 0.233 \text{ (Evaluators' estimation, assuming unknown build age)}$$

$CAPH = \left(\frac{Btu}{hr}\right)$  = rated heating capacity = new furnace heating capacity, see above

*AFUE<sub>base</sub> = 80%*

*Source to site ratio, electric to gas = 1.05*

### **1.13.1.1 Impact of Early Replacement**

The method for calculating the impact of early replacement for residential furnaces applies a degradation factor to the performance a 78 AFUE unit. This is calculated as:

$$AFUE_{base\_early} = (Base\ AFUE) \times (1 - M)^{age}$$

Where:

*Base AFUE* = efficiency of the existing equipment when new, 78% AFUE.

*M* = maintenance factor, 0.01.

*age* = the age of the existing equipment, in years.

Based on the degradation equation and the average age of replaced functional systems of 15.43 years this leads to an Early Retirement AFUE of:

$$AFUE_{base\_early} = 0.78 \times (1 - 0.01)^{15.43} = 0.6680$$

The Evaluators applied this baseline to residential retrofits as well as to master-metered multifamily units.

### **1.13.1.2 Net-to-Gross Ratio**

The net-to-gross rates for the Heating Equipment Rebates residential component are as follows:

- Residential Retrofit: 84.6%
- Residential Retrofit – Multifamily: 76.7%
- Residential New Construction (builder production homes): 92.3%
- Residential New Construction (custom homes): 48.7%
- Residential Fuel Switch: 84.6%
- Smart Thermostats: 100%

Multifamily NTGR is based on the NTGR for the commercial component.

### 1.13.2 Smart Thermostat Energy Savings Calculations

Energy savings values for smart thermostats are calculated as follows:

$$therms_{ex\ post\ savings} = gas\ heating_{default} \times home\ square\ footage$$

Where:

$gas\ heating_{default}$  = 0.033 therms per square feet

$home\ square\ footage$  = verified home square footage, or default square footage of 1,484 SF

### 1.13.3 Water Heating Energy Savings Calculations

Energy savings values for storage tank water heaters were developed using installed Energy Factor ratings as determined by the Gas Appliance Manufacturers Association Directory of Certified Water Heating Products. Tank sizing must follow AHRI standards.

$$therm_{ex\ post\ savings} = therm_{baseline\ water\ heater} - therm_{new\ water\ heater}$$

First the energy use of the new water heater was found.

$therm_{new\ water\ heater} =$

$$\rho \times Cp \times V \times (T_{SetPoint} - T_{Supply}) \times \frac{1}{EF_{Post}} \times \left( \frac{1}{100,000} \right) \times 1.05$$

Where,

$\rho$  = Water density = 8.33 lb./gal

$Cp$  = Specific heat of water = 1 BTU/lb.°F

$V$  = Calculated estimated annual hot water use (gal) = 21,521 (gal)

$T_{SetPoint}$  = Water heater set point (124°F for residential, 120°F for commercial)

$T_{Supply}$  = Calculated average supply water temperature = 63.2°F

$EF_{Post}$  = verified Energy Factor of new water heater

BTU to Therms conversion factor = 100,000 BTU/therm

Source to site ratio, gas to gas = 1.05

Energy use of the baseline water heater is calculated with the equation below.

$therm_{baseline\ water\ heater} =$

$$\rho \times C_p \times V \times (T_{SetPoint} - T_{Supply}) \times \frac{1}{EF_{pre\ electric}} \times \left(\frac{1}{100,000}\right) \times 3.14$$

Where,

$\rho$  = Water density = 8.33 lb./gal

$C_p$  = Specific heat of water = 1 BTU/lb.°F

$V$  = Calculated estimated annual hot water use (gal) = 21,521 (gal)

$T_{SetPoint}$  = Water heater set point (124°F for residential, 120°F for commercial)

$T_{Supply}$  = Calculated average supply water temperature = 63.2°F

$EF_{post}$  = verified Energy Factor of baseline water heater

Volume of water heater = verified water heater's volume, for tankless water heaters the assumed baseline volume is 50 gal

Source to Site ratio, gas to gas = 1.05

Source to Site ratio, electricity to gas = 3.14

Baseline energy factors are summarized in Table 3-1.

*Table 3-1 Residential Water Heating Baseline Uniform Energy Factors*

<i>Draw Pattern</i>	<i>Equivalent Gallons</i>	<i>Baseline UEF</i>
Very Small	20	0.3056
Low	30	0.5412
Medium	40	0.5803
High	50	0.6270

### **1.13.3.1 Net-to-Gross Ratio**

The Evaluators used 2021 survey results in developing the Net-to-Gross Ratios for water heaters.

- Residential Retrofit: 85.0%
- Residential New Construction (builder production homes): 91.7%
- Residential New Construction (custom homes): 64.4%
- Residential Fuel Switch: 85.0%

- Multifamily: 84.4%

Multifamily NTGR is based on the NTGR for the commercial component.

#### 1.13.4 Cooking Range Energy Savings Calculations

The energy savings of a gas range is found by subtraction the energy use of the new range from the energy use from the old range.

$$therm_{ex\ post\ savings} = therm_{baseline\ range} - therm_{new\ range}$$

First the energy use of the baseline range was found.

$$therm_{baseline\ electric\ range} = 716 \left( \frac{kWh}{yr} \right) \times 3,413 \left( \frac{Btu}{kWh} \right) \times \left( \frac{1}{100,000 \frac{Btu}{therm}} \right) \times 3.14$$

$$therm_{baseline\ gas\ range} = 3,986,950\ BTU \times \left( \frac{1}{100,000 \frac{BTU}{therm}} \right) \times 1.05$$

Next the energy use of the newly installed range was found. It is the assumed that the installed range uses that same amount of energy as the baseline gas range

$$therm_{ex\ post\ gas\ range} = therm_{baseline\ gas\ range}$$

Where,

Annual kWh usage of electric range = 716 kWh/yr.

Annual BTU usage of gas range = 3,986,950 BTU

kWh to BTU conversion factor = 3413 BTU/kWh

BTU to Therms conversion factor = 100,000 BTU/Therms

Site-to-Source ratio, electricity to gas = 3.14

Site-to-Source ratio, gas to gas = 1.05

##### 1.13.4.1 Net-to-Gross Ratio

Due to the low participation in the program, the Evaluators used the net-to-gross ratio (NTGR) from Oklahoma Natural Gas's PY2018 evaluation (80%).

#### 1.13.5 Clothes Dryers Energy Savings Calculations

The energy savings of a gas clothes dryer is found by subtraction the energy use of the new dryer from the energy use from the old dryer.

$$therm_{ex\ post\ savings} = therm_{baseline\ dryer} - therm_{new\ dryer}$$

First the energy use of the baseline dryer was found.

$$therm_{baseline\ electric\ range} = 942 \left( \frac{kWh}{yr} \right) \times 3,413 \left( \frac{Btu}{kWh} \right) \times \left( \frac{1}{100,000 \frac{Btu}{therm}} \right) \times 3.14$$

$$therm_{baseline\ gas\ range} = 3,216,455\ BTU \times \left( \frac{1}{100,000 \frac{Btu}{therm}} \right) \times 1.05$$

Next the energy use of the newly installed dryer was found. It is assumed that the installed dryer uses that same amount of energy as the baseline gas dryer

$$therm_{ex\ post\ gas\ range} = therm_{baseline\ gas\ range}$$

Where,

Annual kWh usage of electric dryer = 942 kWh/yr.

Annual BTU usage of gas dryer = 3,216,455 BTU

kWh to BTU conversion factor = 3413 BTU/kWh

BTU to Therms conversion factor = 100,000 BTU/Therm

Site-to-Source ratio, electricity to gas = 3.14

Site-to-Source ratio, gas to gas = 1.05

#### **1.13.5.1 Net-to-Gross Ratio**

Due to the low participation in the program, the Evaluators used the net-to-gross ratio (NTGR) from Oklahoma Natural Gas's PY2018 evaluation (80%).

#### **1.13.6 Space Heating Energy Savings Calculations**

The Evaluators applied AR TRM 8.2 deemed savings parameters in assessing savings of the commercial component.

Savings for commercial furnaces are calculated as follows:

$$therm_{ex\ post\ savings} = therm_{baseline\ heating\ system} - therm_{new\ heating\ system}$$

First the energy use of the new heating system was found.

$$therm_{new\ heating\ system} = Heat\ load \times \left( \frac{1}{AFUE_{new\ heating\ system}} \right)$$

$$Heat\ load = \left( \frac{\frac{therms}{site\ area}}{yr} \right) \times site\ area = \left( \frac{\frac{therms}{site\ area}}{yr} \right) \times \left( \frac{CAP_H}{30} \right) \times 1.05$$

Where,

Site Area = square footage of the project site

CAPH =  $\left(\frac{\text{BTU}}{\text{hr}}\right)$  = verified heating capacity verified by the Evaluators with AHRI number

AFUE<sub>new heating system</sub> = verified by the Evaluators with AHRI number

Source to site ratio, electric to gas = 3.14

Next the energy use of the removed water heater was found.

$$therm_{\text{new heating system}} = \text{Heat load} \times \left(\frac{1}{AFUE_{\text{old heating system}}}\right)$$

$$\text{Heat load} = \left(\frac{\frac{\text{therms}}{\text{site area}}}{\text{yr}}\right) \times \text{site area} = \left(\frac{\frac{\text{therms}}{\text{site area}}}{\text{yr}}\right) \times \left(\frac{CAPH}{30}\right) \times 1.05$$

Where,

$$\left(\frac{\frac{\text{therms}}{\text{site area}}}{\text{yr}}\right) = 0.233 \text{ (Evaluators' estimation, assuming unknown build age)}$$

CAPH =  $\left(\frac{\text{BTU}}{\text{hr}}\right)$  = rated heating capacity = new furnace heating capacity, see above

AFUE<sub>base</sub> = 80%

Source to site ratio, electric to gas = 1.05

#### **1.13.6.1 Impact of Early Replacement**

The early retirement procedure described in Section 1.13.1.1 was applied to commercial projects in master-metered multifamily housing.

#### **1.13.6.2 Net-to-Gross Ratio**

The Evaluators applied the Oklahoma Natural Gas Space Heating free ridership estimate of 16.4% to the commercial segment. The resulting aggregate NTGR for this group was 83.6%.

#### **1.13.7 Water Heating Energy Savings Calculations**

Commercial water heater savings calculations incorporate more facility-specific information than the residential methodology. Therms savings for commercial water heaters are calculated as:

$$\text{Therms Savings} = \frac{\rho * C_p * V * (T_{\text{SetPoint}} - T_{\text{Supply}}) * \left(\frac{1}{EF_{\text{pre}}} - \frac{1}{EF_{\text{post}}}\right) * \text{Days/Year}}{100,000 \text{ BTU/Therm}}$$

Where,

$\rho$  = Water density = 8.33 lb./gal

$C_p$  = Specific heat of water = 1 BTU/lb. °F

$V$  = Calculated estimated annual hot water use

$T_{SetPoint}$  = Water heater set point

$T_{Supply}$  = Calculated average supply water temperature

$EF$  = verified Energy Factor of baseline water heater

Days/Year = Days per year of operation

The required facility-specific inputs are volume and days/year. Volume can be calculated based on square footage of the facility or from units served.

Table 3-2 presents the volume and days of usage values for a facility by square footage. Table 3-3 presents the volume and days of usage values by unit produced or person served.

*Table 3-2 Hot Water Requirements by Facility Size*

<i>Building Type</i>	<i>Daily Demand (Gallons / Unit / Day)</i>	<i>Unit</i>	<i>Units / 1,000 Sq. Feet</i>	<i>Applicable Days / Year</i>	<i>Gallons / 1,000 Sq. Feet / Day</i>
Small Office	1	Person	2.3	250	2.3
Large Office	1	Person	2.3	250	2.3
Fast Food Rest.	.7	Meal/Day	784.6	365	549.2
Sit-down Rest.	2.4	Meal/Day	340	365	816
Retail	2	Employee	1	365	2.0
Grocery	2	Employee	1.1	365	2.2
Warehouse	2	Employee	0.5	250	1.0
Elementary School	0.6	Person	9.5	200	5.7
Jr. High/High School	1.8	Person	9.5	200	17.1
Health	90	Patient	3.8	365	342
Motel	20	Unit (Room)	5	365	100.0
Hotel	14	Unit (Room)	2.2	365	30.8
Other	1	Employee	0.7	250	0.7

*Table 3-3 Hot Water Requirements by Unit or Person*

<i>Building Type</i>	<i>Size Factor</i>	<i>Average Daily Demand</i>
Dormitories	Men	13.1 Gal. per Man
	Women	12.3 Gal. per Woman
Hospitals	Per Bed	90.0 Gal. per Patient
Hotels	Single Room with Bath	50.0 Gal. per Unit
	Double Room with Bath	80.0 Gal. per Unit
Motels	# Units:	
	Up to 20	20.0 Gal. per Unit
	21 to 100	14.0 Gal. per Unit
	101 and Up	10.0 Gal. per Unit
Restaurants	Full Meal Type	2.4 Gal. per Meal
	Dive-in Snack Type	0.7 Gal. per Meal
Schools	Elementary	0.6 Gal. Per Student
	Secondary and High School	1.8 Gal. Per Student

**1.13.7.1 Net-to-Gross Ratio**

The Evaluators applied the Oklahoma Natural Gas Water Heating free ridership estimate of 16% to the commercial segment. The resulting aggregate NTGR for this group was 84%.

**1.13.8 Verified Savings**

Gross savings are summarized in Table 3-4.

*Table 3-4 Verified Gross Therms Savings*

<i>Measure Group</i>	<i>Measure Category</i>	<i>Expected Therms Savings</i>	<i>Verified Therms Savings</i>	<i>Realization Rate</i>	<i>EUL</i>	<i>Lifetime Therms Savings</i>
<b>Space Heating</b>	Single-Family Retrofit	71,927	71,927	100.0%	14.5	1,048,882
	NC - Builder	1,086	1,086	100.0%	20	21,718
	NC – Owner/Custom	1,265	1,265	100.0%	20	25,304
	Multifamily	1,602	1,602	100.0%	20	22,963
	Fuel Switch	27,766	27,766	100.0%	14.4	399,514
	Smart Thermostats	4,569	4,569	100.0%	11	50,747
	Self-Install Smart Thermostat	9,681	9,681	100.0%	11	106,495
<b>Water Heating</b>	Single-Family Retrofit	2,336	2,336	100.0%	20	46,716
	NC - Builder	1,347	1,347	100.0%	20	26,939
	NC – Owner/Custom	710	710	100.0%	20	14,198
	Fuel Switch	4,259	4,259	100.0%	20	85,171
<b>Appliances</b>	Cooking Range	802	802	100.0%	15	12,030
	Clothes Dryer	577	577	100.0%	16	9,230
<b>Commercial</b>	Furnace	19,147	19,147	100.0%	20.0	382,949
	Water Heater	12,961	12,961	100.0%	20.0	259,220
	<b>Overall:</b>	<b>160,035</b>	<b>160,035</b>	<b>100.0%</b>	<b>15.7</b>	<b>2,518,004</b>



Net savings are summarized in Table 3-5.

*Table 3-5 Verified Net Therms Savings*

Measure Group	Measure Category	NTGR		Net Annual Savings		Net Realization Rate	Net Lifetime Therms Savings
		Ex Ante	Ex Post	Ex Ante	Ex Post		
Space Heating	Single-Family Retrofit	85.0%	84.6%	61,102	60,865	99.6%	886,846
	NC - Builder	92.3%	92.3%	1,002	1,002	100.0%	20,046
	NC - Owner	48.7%	48.7%	616	616	100.0%	12,323
	Multifamily Retrofit	85.0%	76.7%	1,361	1,229	90.3%	17,615
	Fuel Switch	85.0%	84.6%	23,587	23,495	99.6%	338,068
	Smart Thermostats	88.9%	88.9%	3,811	3,811	100.0%	45,114
	Self-Install Smart Thermostat	88.9%	88.9%	8,607	8,607	100.0%	94,674
Water Heating	Single-Family Retrofit	85.0%	85.0%	1,984	1,984	100.0%	39,685
	NC - Owner	91.7%	91.7%	1,235	1,235	100.0%	24,703
	NC - Builder	64.4%	64.4%	457	457	100.0%	9,143
	Fuel Switch	85.0%	85.0%	3,618	3,618	100.0%	72,353
Appliances	Cooking Range	80.0%	80.0%	642	642	100.0%	9,624
	Clothes Dryer	80.0%	80.0%	462	462	100.0%	7,384
Commercial	Furnace	70.3%	73.1%	13,466	14,006	104.0%	280,127
	Water Heater	84.4%	84.4%	10,933	10,933	100.0%	218,669
	<b>Overall:</b>	<b>83.1%</b>	<b>83.2%</b>	<b>132,883</b>	<b>132,962</b>	<b>100.1%</b>	<b>2,080,712</b>

## 4. High Efficiency Homes Program

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The High Efficiency Homes Program provides incentives to new construction home builders. Eligible measures for this program include:

- \$1,000 for gas furnaces (primary source) with 95% or higher AFUE;
- natural gas water heating; and
- at least one additional natural gas burner tip.

### 1.14 Program Overview

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High Efficiency Homes Program is designed to encourage new home builders to choose energy efficient natural gas water heating and space heating equipment. The program is marketed to consumers, builders, and developers through local publication, bill inserts, various media avenues, and direct contact.

### 1.15 Participation Summary

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In 2021, program participation consisted of 142 total furnaces – all furnaces were rated at 90–94.9% AFUE.

There were no rebates for furnaces with a 95% or higher AFUE, water heaters, smart thermostats, or natural gas burner tips.

### 1.16 Impact Evaluation

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#### 1.16.1 Space Heating Energy Savings Calculations

Savings for residential furnaces are calculated as follows:

$$therm_{ex\ post\ savings} = therm_{baseline\ heating\ system} - therm_{new\ heating\ system}$$

First the energy use of the new heating system was found.

$$therm_{new\ heating\ system} = Heat\ load \times \left( \frac{1}{AFUE_{new\ heating\ system}} \right)$$
$$Heat\ load = \left( \frac{therms}{site\ area} \right) \times site\ area = \left( \frac{therms}{site\ area} \right) \times \left( \frac{CAP_H}{30} \right) \times 1.05$$

Where,

Site Area = square footage of the project site

$CAP_H = \left( \frac{BTU}{hr} \right)$  = verified heating capacity verified by the Evaluators with AHRI number

AFUE<sub>new heating system</sub> = verified by the Evaluators with AHRI number

Source to site ratio, electric to gas = 3.14

Next the energy use of the removed heater was found.

$$therm_{new\ heating\ system} = Heat\ load \times \left( \frac{1}{AFUE_{old\ heating\ system}} \right)$$

$$Heat\ load = \left( \frac{\frac{therms}{site\ area}}{yr} \right) \times site\ area = \left( \frac{\frac{therms}{site\ area}}{yr} \right) \times \left( \frac{CAPH}{30} \right) \times 1.05$$

Where,

$$\left( \frac{\frac{therms}{site\ area}}{yr} \right) = 0.233 \text{ (Evaluators' estimation, assuming unknown build age)}$$

$$CAPH = \left( \frac{BTU}{hr} \right) = \text{rated heating capacity} = \text{new furnace heating capacity, see above}$$

AFUE<sub>base</sub> = 80%

Source to site ratio, electric to gas = 1.05

### 1.16.2 Net-to-Gross Ratio

The net-to-gross rates for the High Efficiency Homes Program was 90.6%.

## 1.17 Verified Savings

Gross Therms are summarized in Table 4-1.

Table 4-1 Gross Therms Savings

Measure	Expected Therms Savings	Verified Therms Savings	Gross Realizations Rate	Lifetime Therms Savings
Total Gross Savings	20,874	20,874	100.0%	413,067

Net savings are summarized in Table 4-2.

Table 4-2 Net Therms Savings

Measure	NTGR		Net Annual Savings		Net Realization Rate	Net Lifetime Therms Savings
	Ex Ante	Ex Post	Ex Ante	Ex Post		
Total Net Savings	90.6%	90.6%	18,920	18,917	100.0%	374,603

## 5. Commercial Solutions Program

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The Commercial Solutions Program is directed at developing and incenting custom energy efficiency projects for which deemed values are not applicable or feasible. It is implemented by CLEAResult Consulting on behalf of Summit. CLEAResult handles program administration, marketing and outreach, direct install of water conservation and air infiltration measures, and technical review of custom efficiency projects. Program participants are provided:

- (1) No-cost direct installation of low flow faucet aerators, showerheads, door air infiltration and pre-rinse spray valves (PRSVs), if they have gas water heating or comfort heating;
- (2) Prescriptive incentives for boiler and food service measures; and
- (3) \$0.95 per Therms for custom projects.

### 1.18 Commercial Solutions Program Overview

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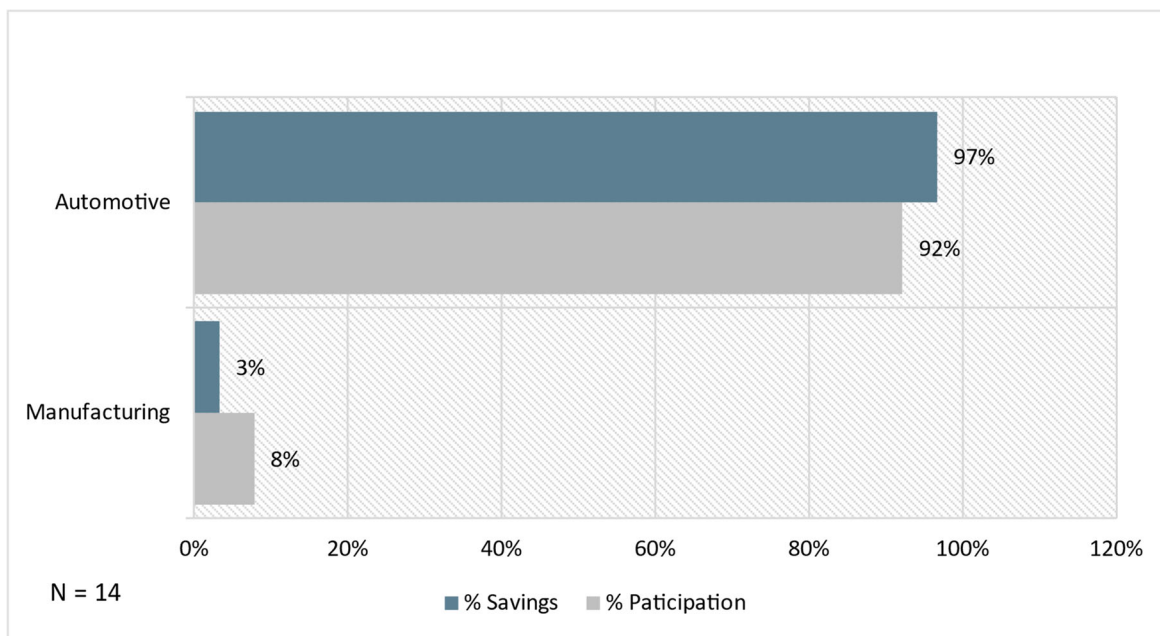
The Commercial Solutions Program is designed to provide no-cost direct installation of water saving and comfort heating measures, energy audits, and incentives for custom projects. The Commercial Solutions Program participants fall into one of four categories:

- Direct install;
- Prescriptive
- Custom audit recipients; and
- Closed custom projects.

In 2021, custom projects accounted for 52.4% of program savings and direct install accounted for 46.2%. These participants are detailed in the subsections to follow.

#### 1.18.1 Direct Install Participation Summary

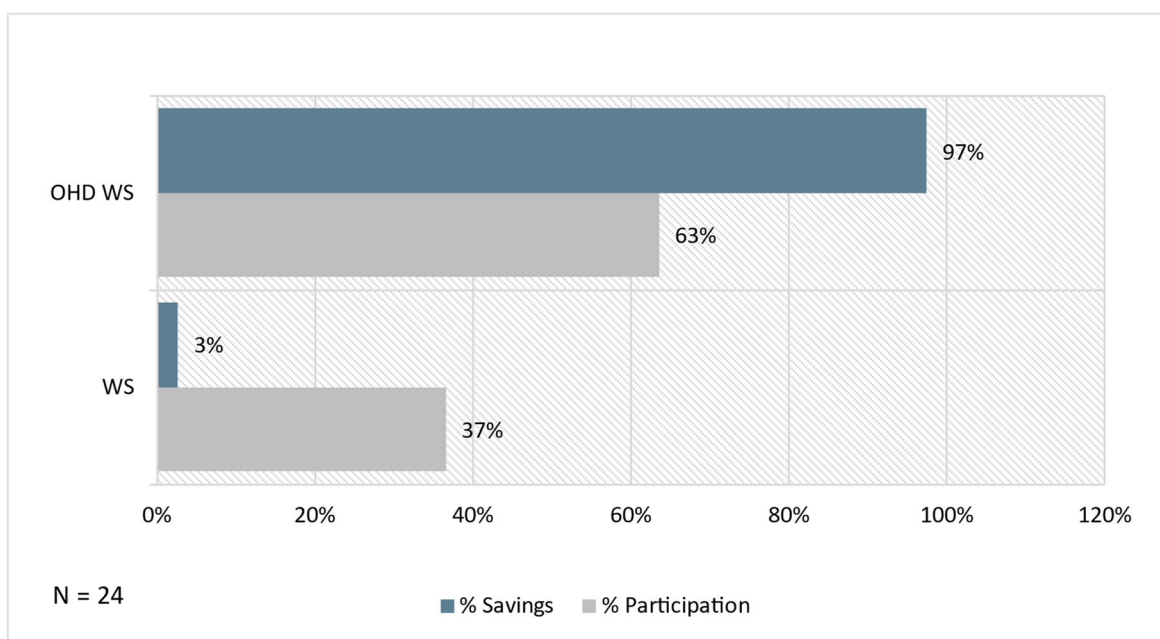
In 2021, 14 distinct premises participated in the direct install component of Commercial Solutions Program. Automotive facilities accounted for the majority (92.2%) of the program savings while the only other facility type was manufacturing which accounted for the remainder (7.8%). Figure 5-1 summarizes the participation by facility type, quantified in percent of participation as well as percent of total savings by facility type.



*Figure 5-1 Commercial Solutions Direct Install Participant Summary by Facility Type*

The number of measures is consistent with the number of rebates issued through the program. In 2021, there were 24 rebates issued through the Direct Install category. Overhead door weather stripping (OHD WS) accounted for the majority (97.4%) of the program savings while the remainder of the savings (2.6%) were from weather stripping (WS).

Figure 5-2 summarizes the participation by measure type, quantified in percent of measure type as well as percent of total savings.



*Figure 5-2 Commercial Solutions Direct Install Participant Summary by Measure Type*

Additionally, compared to PY2020, the types of business that participated in the direct install program were less diverse and almost completely automotive (92.2%). The only other type of business was manufacturing (7.8%).

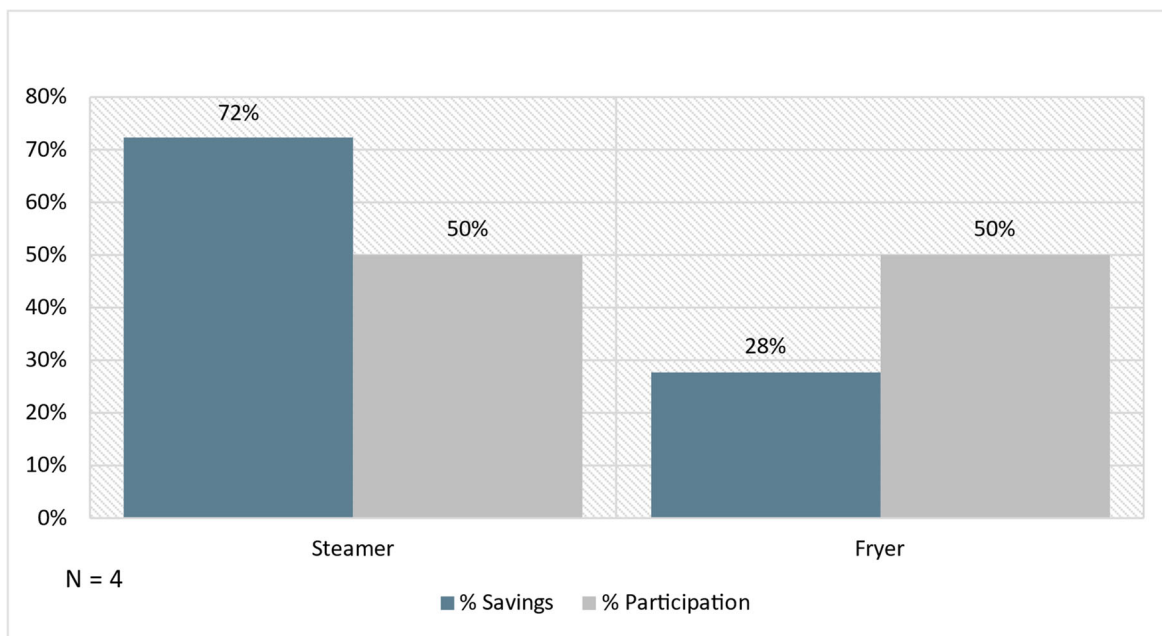
## **1.18.2 Prescriptive Participation Summary**

### **1.18.2.1 Boilers**

In 2021, the Commercial Boiler Program had one participant receive a rebate for one boiler. The participant is a college university.

### **1.18.2.2 Food Service**

In 2021, food service rebates were provided for one facility totaling four units. There were two fryers and two steam cookers that were rebated in 2021. The facility that received the rebates is a public school. Figure 5-3 summarizes food service participation by measure category.



*Figure 5-3 Food Service Participation by Measure Category*

### 1.18.3 Closed Custom and Project Participation Summary

In 2021, C&I Solutions completed four custom projects in three distinct facilities. Table 5-1 summarizes the completed projects for the 2021 C&I Solutions program.

*Table 5-1 Custom Project Participation Summary*

<i>Facility Type</i>	<i>Project ID</i>	<i>Measure</i>
Manufacturing	CNPOK-2021-006	Controls Upgrade
Manufacturing	CNPOK-2021-007	Insulation
Industrial	CNPOK-2021-008	Burner Controls

### 1.19 Commercial Solutions Custom Impact Evaluation

The impact evaluation of the Commercial Solutions Program included the following:

- *Custom Project M&V.* The Evaluators conducted project-specific M&V on a census of the four projects completed through the Commercial Solutions Program (accounting for 100% of program custom savings). Each project included an M&V plan and project-specific report. The reports are provided in Appendix A.

### 1.20 Commercial Solutions Direct Install Impact Evaluation

#### 1.20.1 Energy Savings Calculations

The AR TRM 8.2 includes commercial faucet aerators, pre-rinse spray valves, low-flow showerheads, and weather stripping. The evaluation of the Commercial Solutions program incorporated these deemed values. They are detailed in the subsections to follow. Direct Install projects completed in PY 2021 included the installation of weather stripping only.

### **1.20.1.1 Weather Stripping**

Deemed savings calculations for weather stripping were based upon:

- Air infiltration;
- Cooling and heating equivalent full-load hours; and
- Change in temperature between interior and exterior spaces.

Savings are calculated as follows:

*Annual therms* =

$$\frac{(CFM_{pre,day} * Hours_{day} + CFM_{pre,night} * Hours_{night}) (CFM_{reduction} * 1.08 * \Delta T * \frac{1.0kW}{ton})}{80\% AFUE * \frac{100,000Btu}{therm}}$$

$$Peak\ therms = Annual \frac{therms}{ELFH_H}$$

The inputs for this equation are defined in Table 5-2.

*Table 5-2 DI Weather Stripping Savings Calculation Parameters*

<i>Parameter</i>	<i>Description</i>	<i>Value</i>
CFM <sub>pre</sub>	Calculated pre-retrofit air infiltration rate (ft <sup>3</sup> /min)	
CFM <sub>reduction</sub>	Average infiltration reduction	79%
ΔT	Change in temperature across gap barrier	
Hours <sub>day</sub>	12-hour cycles per day, per month	4,380 hours
Hours <sub>night</sub>	12-hour cycles per day, per month	4,380 hours
EFLH <sub>H</sub>	Average heating equivalent full-load hours	Table 5-3



*Table 5-3 EFLH<sub>H</sub> By Weather Zone*

<i>Building Type</i>	<i>Zone 6</i>	<i>Zone 7</i>	<i>Zone 8</i>	<i>Zone 9</i>
Assembly	575	798	855	824
College/University	630	874	936	902
Fast Food Restaurant	288	440	474	455
Full Menu Restaurant	181	328	370	336
Grocery Store	688	935	995	965
Health Clinic	646	885	922	895
Lodging	389	587	635	605
Large Office (>30k Sq. Ft.)	811	1,014	1,054	1,036
Small Office (≤30k Sq. Ft.)	353	538	568	538
Religious Worship	537	745	798	769
Retail	780	1,041	1,131	1,099
School	774	1,026	1,089	1,064

These values translate into per linear foot savings values by weather zone, detailed in Table 5-4.

*Table 5-4 Deemed Annual Therms Savings per Linear Foot*

<i>Weather Zone</i>	<i>Gap Width (inches)</i>			
	<i>1/8</i>	<i>1/4</i>	<i>1/2</i>	<i>3/4</i>
Zone 9	5.34	10.80	21.43	32.16
Zone 8	4.64	9.38	18.62	27.96
Zone 7	3.91	7.92	15.71	23.58
Zone 6	2.89	5.86	11.62	17.44

### 1.20.2 Boilers

Baseline efficiency for boilers is detailed in Table 5-5.

*Table 5-5 Commercial Boiler Minimum Efficiency Levels*

<i>Project Type</i>	<i>Size Category</i>	<i>Subcategory</i>	<i>Minimum Efficiency</i>
Replace-on-Burnout	< 300,000 BTUh	Hot Water	82% AFUE
		Steam	80% AFUE
	> 300,000 BTUh and < 2,500,000 BTUh	Hot Water	80% Et
		Steam	79% Et
	> 2,500,000 BTUh	Hot Water	82% Ec
		Steam	79% Et
Early Retirement	< 300,000 BTUh	Hot Water	80% AFUE
		Steam	75% AFUE
	> 300,000 BTUh and < 2,500,000 BTUh	Hot Water	75% Et
		Steam	75% Et
	> 2,500,000 BTUh	Hot Water	80% Ec
		Steam	80% Et

Savings for commercial boilers are calculated as:

$$\text{Therms Savings} = \frac{\text{BTU Capacity} * \text{EFLH}_H * \left( \frac{1}{\text{Effic}_{pre}} - \frac{1}{\text{Effic}_{post}} \right)}{100,000 \text{ Therms/BTU}}$$

The Evaluators recreated the deemed savings calculations for the boiler rebated through the program in 2021.

### 1.20.3 Food Service

The Evaluators applied deemed savings algorithms from Section 3.8.4 – 3.8.6 of AR TRM 8.2 in calculating savings for measures included in the Commercial Food Service Program. There were no convection or combination ovens installed during PY 2021.

The Evaluators conducted a review of the key parameters contributing to savings for equipment rebated in the Commercial Food Service Program. From this, a table was developed allowing Summit to update energy savings calculations using the characteristics of the equipment purchased. In the subsections to follow, the deemed savings tables will present:

- Baseline specifications from the AR TRM V8.2;
- Efficient specifications from the AR TRM V8.2; and
- Average verified specifications from the Evaluators' review of units rebated in the program.

#### 1.20.3.1 Fryer Savings Calculations

Savings for high efficiency fryers were calculated using similar algorithms as detailed for convection ovens. Table 5-6 summarizes the inputs used in the savings algorithm.

*Table 5-6 Calculation Inputs for Fryers*

<i>Parameter</i>	<i>Baseline Model</i>	<i>Efficient Model</i>
Preheat Energy (BTU/Day)	16,000	15,500
Idle Rate (BTU/h)	14,000	9,000
Cooking Eff. (%)	35%	50%
Capacity (lbs./hr.)	60	65
Lbs. of food Cooked/Day	150	150
Efood (BTU/lb./)	570	570
Hours/Day	12	12

#### 1.20.3.2 Steam Cooker Savings Calculations

Measure savings were calculated following the methodology outlined in AR TRM 8.2 Section 3.8.7. The following equations describe the approach.

$$\Delta Energy_{therms} = Energy_{base} - Energy_{efficient}$$

$$Energy_{base, efficient} = Energy_{cooking} + Energy_{idle} + Energy_{steam} + Energy_{preheat}$$

$$Energy_{cooking} = (LB_{food} \times (E_{food}/Cook_{eff})) \times Days$$

$$Energy_{idle} = (1 - \%Steam) \times Idle \times \left( Daily_{Hrs} - \frac{LB_{food}}{Capacity} - \frac{Time_{preheat}}{60} \right) \times Days$$

$$Energy_{steam} = \%Steam \times Capacity \times \frac{E_{food}}{Cook_{eff}} \times \left( Daily_{Hrs} - \frac{LB_{food}}{Capacity} - \frac{Time_{preheat}}{60} \right) \times Days$$

$$Energy_{preheat} = Preheat \times Days$$

The following tables outline the savings calculation inputs that were used.

*Table 5-7 Steam Cooker Deemed Savings*

<i>Pan Capacity</i>	<i>Cooking Efficiency</i>	<i>Idle Rate (Btu/h)</i>
5-pan	38%	10,400
6-pan and larger	38%	12,500

*Table 5-8 Deemed Savings Assumptions for Gas Steam Cookers*

<i>Parameter</i>	<i>Baseline Model</i>	<i>Efficient Gas Model</i>
Cooking Efficiency (%)	18%	Use actual
Preheat Energy (Btu)	20,000	9,000
Constant Steam Mode Time (%)	0.9	0.1
Lbs. of food Cooked/Day	100	100
Production Capacity (lbs./h/pan)	23.3	Use actual
Idle Energy Rate (Btu/h/pan)	3,000	Use actual
Water Consumption Rate (gal/hr)	36	Use actual

## 1.21 Net-to-Gross Ratios (NTGR)

The Evaluators applied the Oklahoma Natural Gas NTGR of 97.9% for Direct Install Projects.

The Evaluators applied NTGR of 100% for Custom and prescriptive projects.

## 1.22 Verified Savings

Table 5-9 presents the gross savings results of the evaluation of the 2021 Commercial Solutions Program. Total Gross Savings summarizes the savings calculations performed by AR TRM 8.2 protocols and custom analyses.

*Table 5-9 Commercial Solutions Verified Therms Savings*

<i>Component</i>	<i>Measure</i>	<i>Expected Therms Savings</i>	<i>Verified Therms Savings</i>	<i>EUL</i>	<i>Lifetime Therms Savings</i>
Direct Install	Weather Stripping	269,831	269,831	11	2,968,141
Prescriptive	Boilers	2,287	2,287	20	45,740
	Food Service	2,149	5,034	12	60,408
Custom	Various	206,320	201,879	9.52	3,206,010
<b>Total Gross Savings</b>		<b>480,587</b>	<b>479,031</b>	<b>-</b>	<b>6,280,299</b>

Net savings for the Commercial Solutions program were calculated using free ridership rates based on participant surveys for the direct install and custom components. The resulting net savings are presented in Table 5-10.

*Table 5-10 Commercial Solutions Net Savings Summary*

<i>Component</i>	<i>NTGR</i>		<i>Net Annual Savings</i>		<i>Net Realization Rate</i>	<i>Net Lifetime Therms Savings</i>
	<i>Ex Ante</i>	<i>Ex Post</i>	<i>Ex Ante</i>	<i>Ex Post</i>		
Direct Install	97.85%	97.85%	264,029	264,029	100.00%	2,841,876
Prescriptive	100.00%	100.00%	3,495	5,722	163.72%	106,148
Custom	100.00%	100.00%	206,320	201,879	97.85%	3,206,010
<b>Overall:</b>	<b>98.7%</b>	<b>98.7%</b>	<b>473,844</b>	<b>471,630</b>	<b>99.53%</b>	<b>6,154,034</b>

Additionally, the PY2021 Commercial Solutions Program can claim non-energy benefits (NEBs) from the two commercial steam cooker units that were rebated through the Food Service component. Efficient steam cooker models consume less water than conventional units, therefore the steamers can claim water savings. Deemed water savings for steam cookers were gathered from the AR TRM 8.2 Section 3.8.7. The overall water savings from the steam cookers are shown below in Table 5-11.

*Table 5-11 PY2021 Steam Cooker Deemed Water Savings*

<i>Measure</i>	<i>Annual Water Savings (Gal)</i>	<i>Lifetime Water Savings (Gal)</i>
Steam Cooker	210,240	2,522,880

## 6. Home Energy Reports

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The Home Energy Reports Program is an educational program run by Oracle, a third-party implementer for Summit. The program provides educational materials to a sample of Summit’s residential customers, in which their usage is compared against similar households. The program is designed to encourage behavioral change and program participation on the part of the recipients of the Home Energy Report.

### 1.23 Participation Summary

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The Home Energy Reports Program began in October 2011. The program is designed to generate quantifiable behavioral savings that cannot be feasibly attained through standard DSM efforts. The program differs from standard energy conservation marketing efforts in that it provides unique reports to each customer, comparing their gas bills against those of similar-sized homes in their neighborhood. The comparison against their neighbors is intended to have a jarring effect; when informed that their usage is above average, the program theory would assert that they are then driven to engage in conservation behaviors.

Over time, the population of recipients faces attrition. This occurs mostly due to members of the recipient group moving to a new residence. Table 6-1 summarizes the participation counts present for the 2021 program year.

*Table 6-1 Home Energy Reports Recipient Attrition*

<i>Program Year</i>	<i>Wave 1</i>	<i>Wave 2</i>	<i>Wave 3</i>	<i>Wave 4</i>
2021	14,776	6,722	6,252	9,132

#### 1.23.1 Savings Calculation Methodologies

The post-program regression (PPR) model combines both cross-sectional and time series data in a panel dataset. This model uses only the post-program data, with lagged energy use for the same calendar month of the pre-program period acting as a control for any small systematic differences between the participant and control customers. In particular, energy use in calendar month  $t$  of the post-program period is framed as a function of both the participant variable and energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between participants and controls will be reflected in differences in their past energy use, which is highly correlated with their current energy use. The version we estimate includes monthly fixed effects and interacts these monthly fixed effects with the pre-program energy use variable. These interaction terms allow pre-program usage to have a different effect on post-program usage in each calendar month.

The model specification is as follows:

$$\begin{aligned}
Usage_{it} = & \alpha_0 + \beta * treatment_i \\
& + \alpha_1 * PreUsage_i \\
& + \alpha_2 * PreUsageSummer_i \\
& + \alpha_3 * PreUsageWinter_i \\
& + \gamma * mm_t \\
& + \delta_1 * mm_t * PreUsage_i \\
& + \delta_2 * mm_t * PreUsageSummer_i \\
& + \delta_3 * mm_t * PreUsageWinter_i \\
& + \varepsilon_{it}
\end{aligned}$$

Where

- $i$  denotes the  $i$ th customer
- $t$  denotes the first, second, third, etc. month of the post-treatment period
- $Usage_{it}$  is the average daily use for reading  $t$  for household  $i$  during the post-treatment period
- $PreUsage_i$  is the average daily usage across household  $i$ 's available pre-treatment billing reads.
- $mm_t$  is a vector of month-year dummies

And parameter definitions are:

- $\alpha_0$  is an intercept term
- $\alpha_1, \alpha_2, \alpha_3$  are effects of control variables  $PreUsage_i$ ,  $PreUsageSummer_i$ , and  $PreUsageWinter_i$  on  $Usage_{it}$  in the reference month.
- $\delta_1, \delta_2, \delta_3$  are the effect of the control variables  $PreUsage_i$ ,  $PreUsageSummer_i$ , and  $PreUsageWinter_i$  in each month-year ( $mm_t$ ) of the post period.
- $\varepsilon_{it}$  is an error term.

In this specification, savings are calculated by:

- Savings =  $\sum$  (Treatment\_Coeff \* Number of recipients in month  $i$  \* Number of days in month  $i$ )

Where,

- Treatment\_Coeff = Coefficient for treatment parameter (daily use is the dependent variable, a negative value for treatment reflects the difference in Therms/day used by the recipient group after report delivery)
- Number of recipients in month i = Total recipients in the Wave, after accounting for attrition, for each month
- Number of days in month i = For month i, the number of days in the month

### 1.23.2 Home Energy Report Net Savings

The HER program uses a randomized control trial, comparing recipients to non-recipients. As a result, the savings estimates from the model are net savings estimates, and no further deduction of free ridership is taken.

### 1.24 Model Output Results

Table 6-2 shows the pre-period interval for each wave, based on one year of billing data before the program start date. For each wave, the same interval was found for both recipient and controls groups, which allows for a proper comparison of pre-usage.

*Table 6-2 Pre-period Interval*

<i>Wave</i>	<i>Start Year/Month</i>	<i>End Year/Month</i>
1	2010-07	2011-09
2	2013-06	2014-08
3	2015-11	2017-01
4	2018-07	2019-09

**1.24.1 Wave 1**

Table 6-3 provides the model coefficients for the regression of customer billing data in the analysis of Wave 1.

*Table 6-3 Regression Coefficients & Model Details – Wave 1*

<i>Variable Description</i>	<i>Regression Coefficient</i>	<i>Standard Error</i>	<i>T-Stat</i>	<i>PR &gt;  T </i>
Intercept	0.76	0.03	26.34	<0.00001
Treatment	-0.03	0.01	-4.74	<0.00001
February	0.47	0.05	9.40	<0.00001
March	-0.14	0.04	-3.51	0.00
April	0.60	0.01	40.44	<0.00001
May	0.36	0.04	8.91	<0.00001
June	-0.31	0.04	-7.88	<0.00001
July	-0.52	0.04	-13.06	<0.00001
August	-0.67	0.04	-16.67	<0.00001
September	-0.67	0.04	-16.26	<0.00001
October	-0.63	0.04	-15.67	<0.00001
November	-0.60	0.04	-14.95	<0.00001
December	-0.65	0.04	-16.15	<0.00001
Pre-usage	-0.68	0.04	-17.44	<0.00001
Pre-summer	-0.43	0.04	-10.63	<0.00001
Pre-winter	-0.23	0.04	-5.67	<0.00001
Pre-usage: February	-0.28	0.07	-3.96	0.00
Pre-usage: March	-0.01	0.07	-0.20	0.84
Pre-usage: April	0.27	0.07	3.86	0.00
Pre-usage: May	-0.18	0.07	-2.55	0.01
Pre-usage: June	-0.37	0.07	-5.02	<0.00001
Pre-usage: July	-0.40	0.07	-5.81	<0.00001
Pre-usage: August	-0.41	0.07	-5.85	<0.00001
Pre-usage: September	-0.40	0.07	-5.75	<0.00001
Pre-usage: October	-0.16	0.07	-2.32	0.02
Pre-usage: November	0.46	0.07	6.48	<0.00001
Pre-usage: December	0.45	0.07	6.36	<0.00001
Pre-summer: February	0.24	0.06	4.15	0.00
Pre-summer: March	0.09	0.06	1.56	0.12
Pre-summer: April	0.06	0.06	1.11	0.27
Pre-summer: May	0.76	0.06	13.16	<0.00001



<i>Variable Description</i>	<i>Regression Coefficient</i>	<i>Standard Error</i>	<i>T-Stat</i>	<i>PR &gt;  T </i>
Pre-summer: June	0.78	0.06	13.23	<0.00001
Pre-summer: July	0.63	0.06	11.01	<0.00001
Pre-summer: August	0.55	0.06	9.43	<0.00001
Pre-summer: September	0.64	0.06	11.21	<0.00001
Pre-summer: October	0.49	0.06	8.74	<0.00001
Pre-summer: November	-0.36	0.06	-6.16	<0.00001
Pre-summer: December	-0.33	0.06	-5.70	<0.00001
Pre-winter: February	0.29	0.02	13.65	<0.00001
Pre-winter: March	-0.38	0.02	-18.90	<0.00001
Pre-winter: April	-0.58	0.02	-28.05	<0.00001
Pre-winter: May	-0.61	0.02	-29.26	<0.00001
Pre-winter: June	-0.62	0.02	-28.16	<0.00001
Pre-winter: July	-0.61	0.02	-29.34	<0.00001
Pre-winter: August	-0.61	0.02	-29.00	<0.00001
Pre-winter: September	-0.61	0.02	-29.30	<0.00001
Pre-winter: October	-0.61	0.02	-30.17	<0.00001
Pre-winter: November	-0.54	0.02	-25.47	<0.00001
Pre-winter: December	-0.41	0.02	-19.18	<0.00001
Adjusted R-Square: 0.752				

The resulting annual savings are:

- Annual Savings =  

$$\sum (0.02747 * \text{Number of customers in month } i * \text{Number of days in month } i) =$$
143,550 Therms
- 95% Confidence Interval: +/- 59,333 (41.3%)

**1.24.2 Wave 2**

Table 6-4 provides the model coefficients for the regression of customer billing data in the analysis of Wave 2.

*Table 6-4 Regression Coefficients & Model Details – Wave 2*

<i>Variable Description</i>	<i>Regression Coefficient</i>	<i>Standard Error</i>	<i>T-Stat</i>	<i>PR &gt;  T </i>
Intercept	0.57	0.03	22.08	<0.00001
Treatment	-0.03	0.01	-5.75	<0.00001
February	0.24	0.05	5.12	<0.00001
March	-0.19	0.04	-4.70	<0.00001
April	0.60	0.02	38.13	<0.00001
May	-0.08	0.04	-2.07	0.04
June	-0.24	0.04	-6.75	<0.00001
July	-0.36	0.04	-9.99	<0.00001
August	-0.41	0.04	-11.29	<0.00001
September	-0.44	0.04	-11.78	<0.00001
October	-0.44	0.04	-12.14	<0.00001
November	-0.46	0.04	-12.54	<0.00001
December	-0.47	0.04	-12.82	<0.00001
Pre-usage	-0.47	0.04	-13.09	<0.00001
Pre-summer	-0.33	0.04	-9.04	<0.00001
Pre-winter	-0.12	0.04	-3.32	0.00
Pre-usage: February	-0.44	0.06	-6.87	<0.00001
Pre-usage: March	0.19	0.06	2.97	0.00
Pre-usage: April	0.23	0.06	3.58	0.00
Pre-usage: May	-0.12	0.06	-1.79	0.07
Pre-usage: June	-0.21	0.07	-3.13	0.00
Pre-usage: July	-0.27	0.06	-4.17	0.00
Pre-usage: August	-0.25	0.07	-3.80	0.00
Pre-usage: September	-0.23	0.06	-3.54	0.00
Pre-usage: October	0.04	0.06	0.64	0.52
Pre-usage: November	0.28	0.07	4.32	0.00
Pre-usage: December	0.26	0.07	3.97	0.00
Pre-summer: February	0.42	0.06	7.24	<0.00001
Pre-summer: March	0.20	0.06	3.56	0.00
Pre-summer: April	0.25	0.06	4.31	0.00
Pre-summer: May	0.74	0.06	12.74	<0.00001

<i>Variable Description</i>	<i>Regression Coefficient</i>	<i>Standard Error</i>	<i>T-Stat</i>	<i>PR &gt;  T </i>
Pre-summer: June	0.77	0.06	13.02	<0.00001
Pre-summer: July	0.71	0.06	12.34	<0.00001
Pre-summer: August	0.69	0.06	11.76	<0.00001
Pre-summer: September	0.70	0.06	12.04	<0.00001
Pre-summer: October	0.57	0.06	10.04	<0.00001
Pre-summer: November	0.08	0.06	1.31	0.19
Pre-summer: December	-0.02	0.06	-0.34	0.74
Pre-winter: February	0.41	0.02	18.24	<0.00001
Pre-winter: March	-0.42	0.02	-19.28	<0.00001
Pre-winter: April	-0.55	0.02	-24.75	<0.00001
Pre-winter: May	-0.58	0.02	-25.94	<0.00001
Pre-winter: June	-0.60	0.02	-26.39	<0.00001
Pre-winter: July	-0.58	0.02	-26.17	<0.00001
Pre-winter: August	-0.59	0.02	-26.12	<0.00001
Pre-winter: September	-0.59	0.02	-26.36	<0.00001
Pre-winter: October	-0.63	0.02	-28.65	<0.00001
Pre-winter: November	-0.49	0.02	-21.72	<0.00001
Pre-winter: December	-0.36	0.02	-15.96	<0.00001
Adjusted R-Square: 0.747				

The resulting annual savings are:

- Annual Savings =  

$$\sum (0.03025 * \text{Number of customers in month } i * \text{Number of days in month } i) =$$
71,539 Therms
- 95% Confidence Interval: +/- 24,367 (34.1%)

**1.24.3 Wave 3**

Table 6-5 provides the model coefficients for the regression of customer billing data in the analysis of Wave 3.

*Table 6-5 Regression Coefficients & Model Details – Wave 3*

<i>Variable Description</i>	<i>Regression Coefficient</i>	<i>Standard Error</i>	<i>T-Stat</i>	<i>PR &gt;  T </i>
Intercept	0.60	0.02	33.29	<0.00001
Treatment	-0.01	0.00	-2.28	0.02
February	0.16	0.03	5.16	<0.00001
March	-0.14	0.04	-3.91	0.00
April	0.84	0.01	66.37	<0.00001
May	0.35	0.03	13.76	<0.00001
June	-0.26	0.03	-10.32	<0.00001
July	-0.54	0.03	-21.58	<0.00001
August	-0.84	0.03	-32.92	<0.00001
September	-0.67	0.03	-25.62	<0.00001
October	-0.54	0.03	-21.45	<0.00001
November	-0.53	0.03	-20.53	<0.00001
December	-0.61	0.03	-24.02	<0.00001
Pre-usage	-0.64	0.02	-25.78	<0.00001
Pre-summer	-0.33	0.03	-12.76	<0.00001
Pre-winter	-0.17	0.03	-6.71	<0.00001
Pre-usage: February	-0.10	0.04	-2.30	0.02
Pre-usage: March	0.20	0.04	4.55	<0.00001
Pre-usage: April	0.70	0.04	15.82	<0.00001
Pre-usage: May	0.76	0.04	17.03	<0.00001
Pre-usage: June	0.20	0.05	4.25	0.00
Pre-usage: July	-0.07	0.04	-1.54	0.12
Pre-usage: August	-0.19	0.05	-4.27	0.00
Pre-usage: September	-0.02	0.04	-0.44	0.66
Pre-usage: October	0.22	0.04	5.12	<0.00001
Pre-usage: November	0.08	0.05	1.86	0.06
Pre-usage: December	-0.01	0.04	-0.19	0.85
Pre-summer: February	0.15	0.05	3.01	0.00
Pre-summer: March	0.32	0.05	6.42	<0.00001
Pre-summer: April	0.29	0.05	5.84	<0.00001
Pre-summer: May	0.90	0.05	17.41	<0.00001

<i>Variable Description</i>	<i>Regression Coefficient</i>	<i>Standard Error</i>	<i>T-Stat</i>	<i>PR &gt;  T </i>
Pre-summer: June	0.79	0.05	14.99	<0.00001
Pre-summer: July	0.62	0.05	12.70	<0.00001
Pre-summer: August	0.75	0.05	14.22	<0.00001
Pre-summer: September	0.74	0.05	14.34	<0.00001
Pre-summer: October	0.66	0.05	13.38	<0.00001
Pre-summer: November	0.16	0.05	3.06	0.00
Pre-summer: December	-0.12	0.05	-2.20	0.03
Pre-winter: February	0.26	0.02	14.68	<0.00001
Pre-winter: March	-0.58	0.02	-33.14	<0.00001
Pre-winter: April	-0.89	0.02	-49.68	<0.00001
Pre-winter: May	-1.06	0.02	-58.98	<0.00001
Pre-winter: June	-0.93	0.02	-49.84	<0.00001
Pre-winter: July	-0.85	0.02	-47.56	<0.00001
Pre-winter: August	-0.82	0.02	-44.77	<0.00001
Pre-winter: September	-0.86	0.02	-47.81	<0.00001
Pre-winter: October	-0.88	0.02	-50.02	<0.00001
Pre-winter: November	-0.57	0.02	-31.08	<0.00001
Pre-winter: December	-0.34	0.02	-18.47	<0.00001
Adjusted R-Square: 0.774				

The resulting annual savings are:

- Annual Savings =  

$$\sum (0.01082 * \text{Number of customers in month } i * \text{Number of days in month } i) =$$
23,587 Therms
- 95% Confidence Interval: +/- 20,309 (86.1%)

**1.24.4 Wave 4**

Table 6-6 provides the model coefficients for the regression of customer billing data in the analysis of Wave 4.

*Table 6-6 Regression Coefficients & Model Details – Wave 4*

<i>Variable Description</i>	<i>Regression Coefficient</i>	<i>Standard Error</i>	<i>T-Stat</i>	<i>PR &gt;  T </i>
Intercept	0.39	0.01	26.86	<0.00001
Treatment	-0.02509	0.00	-7.06	<0.00001
February	0.70	0.04	19.98	<0.00001
March	-0.25	0.03	-7.84	<0.00001
April	0.58	0.01	44.94	<0.00001
May	0.30	0.02	14.94	<0.00001
June	-0.18	0.02	-9.17	<0.00001
July	-0.32	0.02	-16.11	<0.00001
August	-0.33	0.02	-15.89	<0.00001
September	-0.34	0.02	-16.46	<0.00001
October	-0.33	0.02	-16.25	<0.00001
November	-0.32	0.02	-15.65	<0.00001
December	-0.32	0.02	-15.80	<0.00001
Pre-usage	-0.33	0.02	-16.60	<0.00001
Pre-summer	-0.36	0.02	-17.08	<0.00001
Pre-winter	-0.24	0.02	-11.31	<0.00001
Pre-usage: February	0.25	0.05	5.07	<0.00001
Pre-usage: March	0.09	0.05	1.77	0.08
Pre-usage: April	0.23	0.05	4.56	<0.00001
Pre-usage: May	-0.07	0.05	-1.46	0.14
Pre-usage: June	-0.46	0.05	-8.97	<0.00001
Pre-usage: July	-0.59	0.05	-11.67	<0.00001
Pre-usage: August	-0.62	0.05	-12.20	<0.00001
Pre-usage: September	-0.57	0.05	-11.21	<0.00001
Pre-usage: October	-0.34	0.05	-6.71	<0.00001
Pre-usage: November	-0.09	0.05	-1.66	0.10
Pre-usage: December	-0.39	0.05	-7.40	<0.00001
Pre-summer: February	-0.02	0.04	-0.41	0.68
Pre-summer: March	0.57	0.04	12.98	<0.00001
Pre-summer: April	0.60	0.04	13.49	<0.00001
Pre-summer: May	0.96	0.04	21.32	<0.00001

<i>Variable Description</i>	<i>Regression Coefficient</i>	<i>Standard Error</i>	<i>T-Stat</i>	<i>PR &gt;  T </i>
Pre-summer: June	1.06	0.05	23.28	<0.00001
Pre-summer: July	0.91	0.05	20.24	<0.00001
Pre-summer: August	0.87	0.05	19.13	<0.00001
Pre-summer: September	0.87	0.05	19.19	<0.00001
Pre-summer: October	0.64	0.04	14.61	<0.00001
Pre-summer: November	0.28	0.05	6.02	<0.00001
Pre-summer: December	0.31	0.05	6.61	<0.00001
Pre-winter: February	0.12	0.02	6.81	<0.00001
Pre-winter: March	-0.51	0.02	-28.47	<0.00001
Pre-winter: April	-0.68	0.02	-37.68	<0.00001
Pre-winter: May	-0.75	0.02	-40.42	<0.00001
Pre-winter: June	-0.65	0.02	-34.83	<0.00001
Pre-winter: July	-0.61	0.02	-32.87	<0.00001
Pre-winter: August	-0.59	0.02	-31.86	<0.00001
Pre-winter: September	-0.61	0.02	-32.91	<0.00001
Pre-winter: October	-0.62	0.02	-33.89	<0.00001
Pre-winter: November	-0.43	0.02	-22.73	<0.00001
Pre-winter: December	-0.15	0.02	-8.10	<0.00001
Adjusted R-Square: 0.813				

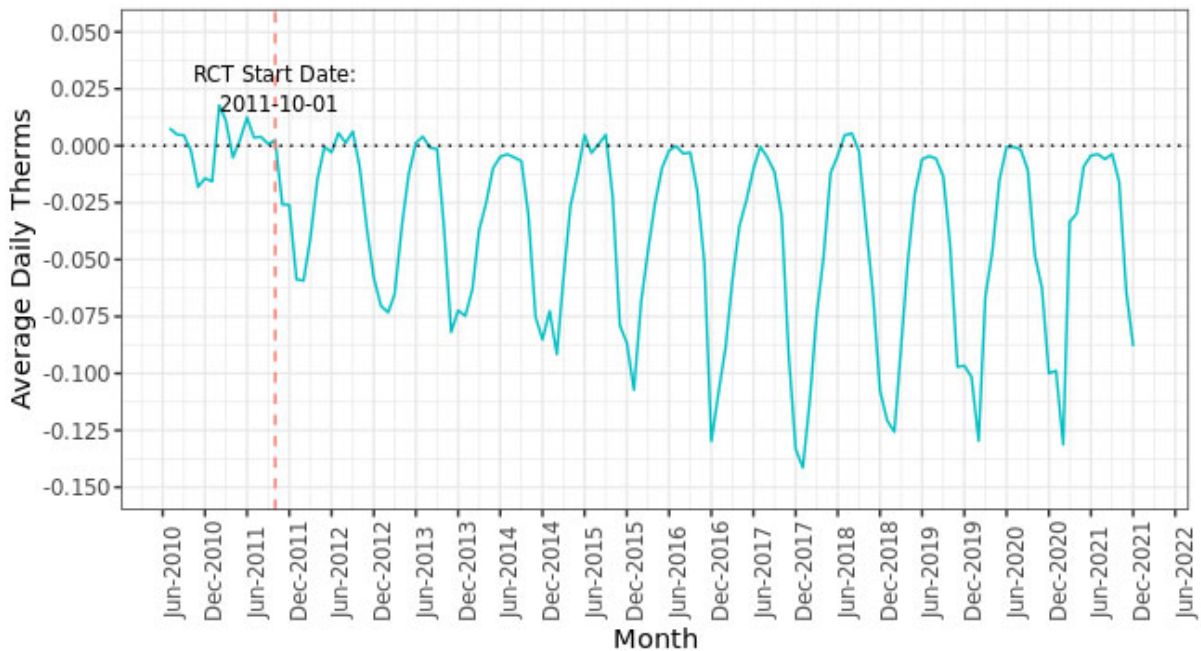
The resulting annual savings are:

- Annual Savings =  

$$\sum (0.02509 * \text{Number of customers in month } i * \text{Number of days in month } i) =$$
76,814 Therms
- 95% Confidence Interval: +/- 21,326 (27.8%)

### 1.25 Group Comparison

The difference in consumption between the recipient and control groups is observable when presented graphically. Figure 6-1 presents the monthly differences in consumption between the two groups. Reports were first delivered in October of 2011, and at that point, the magnitude of difference in consumption increases. Further, the difference in use between the recipient and control group increases every year thereafter.



*Figure 6-1 Daily Consumption between Recipient & Control Group – Wave 1*

Similar representations for Wave 2, Wave 3, and Wave 4 are presented in Figure 6-2, Figure 6-3, and Figure 6-4, respectively. The impacts of the reports for Wave 3 and Wave 4 are somewhat lower than Wave 1 and 2. Wave 1 and Wave 2 show a pattern of increased difference in usage between participant and control groups over time, where this pattern is slowly starting to become recognizable in both Wave 3 and Wave 4.



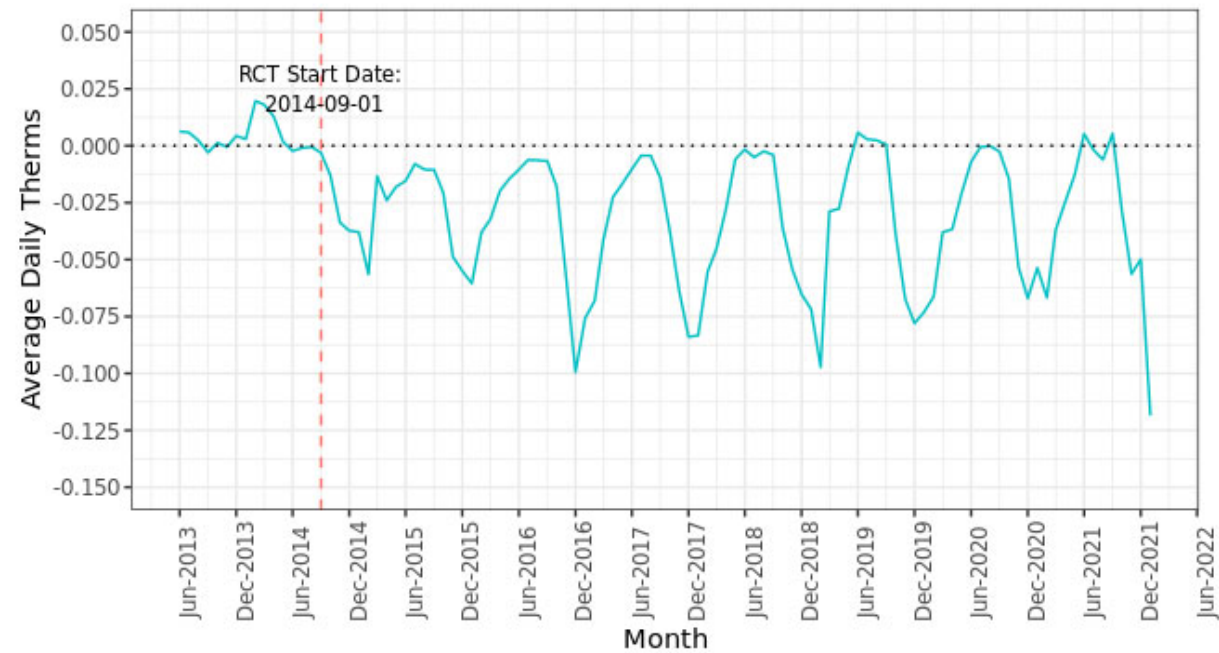


Figure 6-2 Daily Consumption between Recipient & Control Group – Wave 2

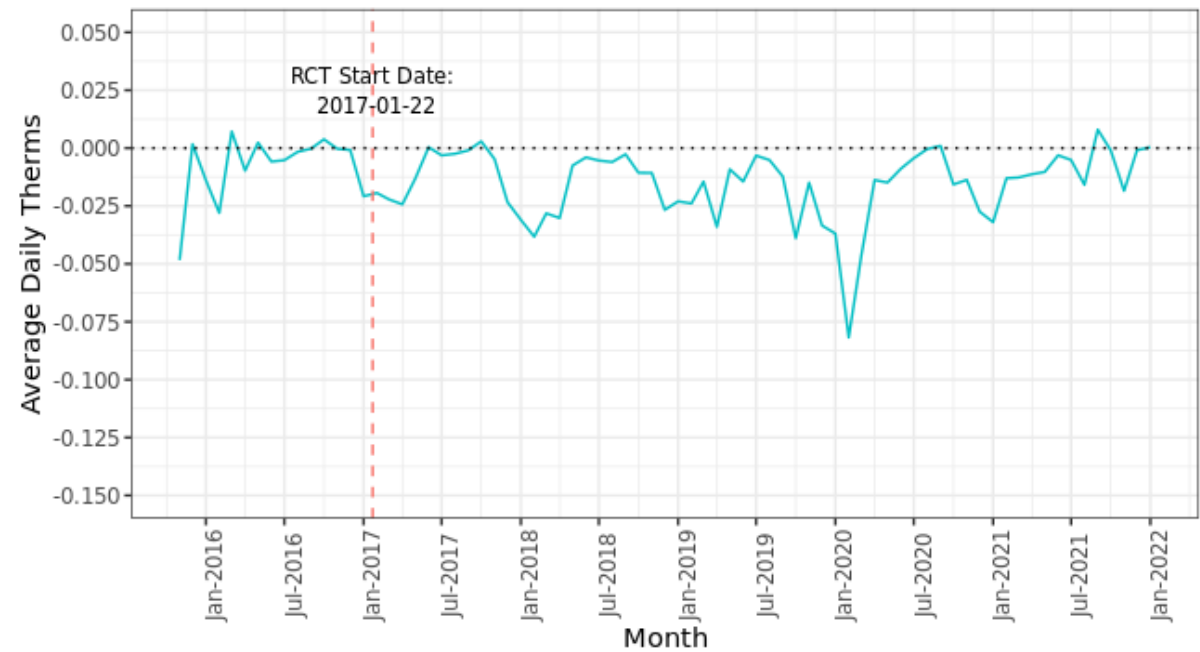


Figure 6-3 Daily Consumption between Recipient & Control Group – Wave 3

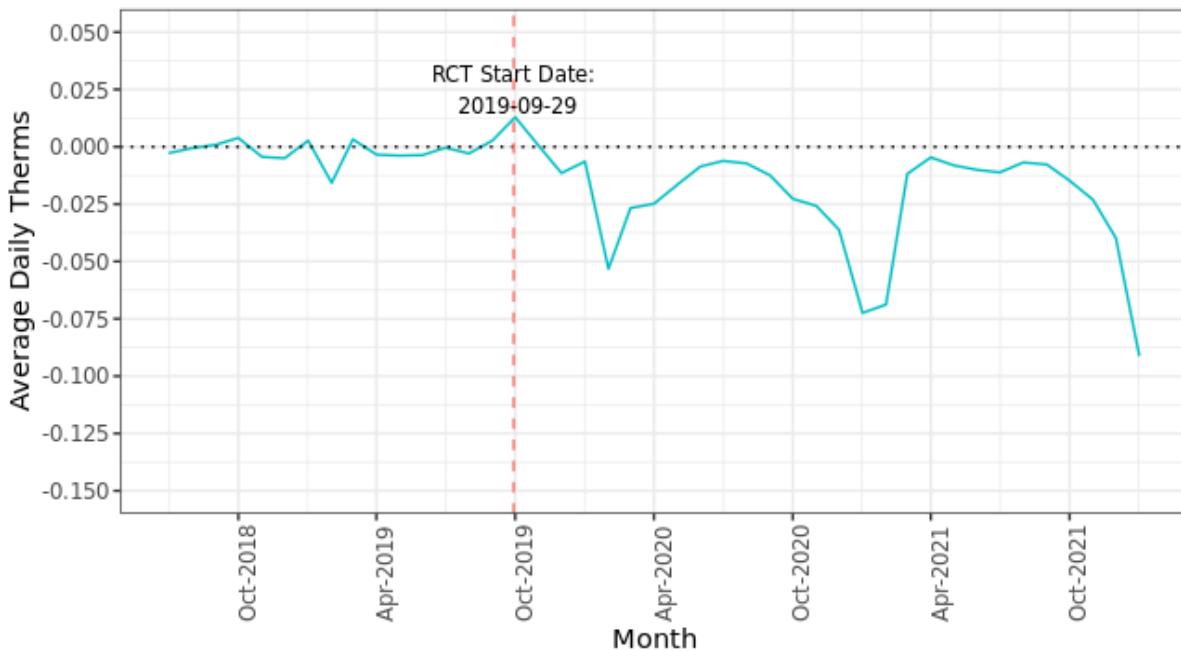
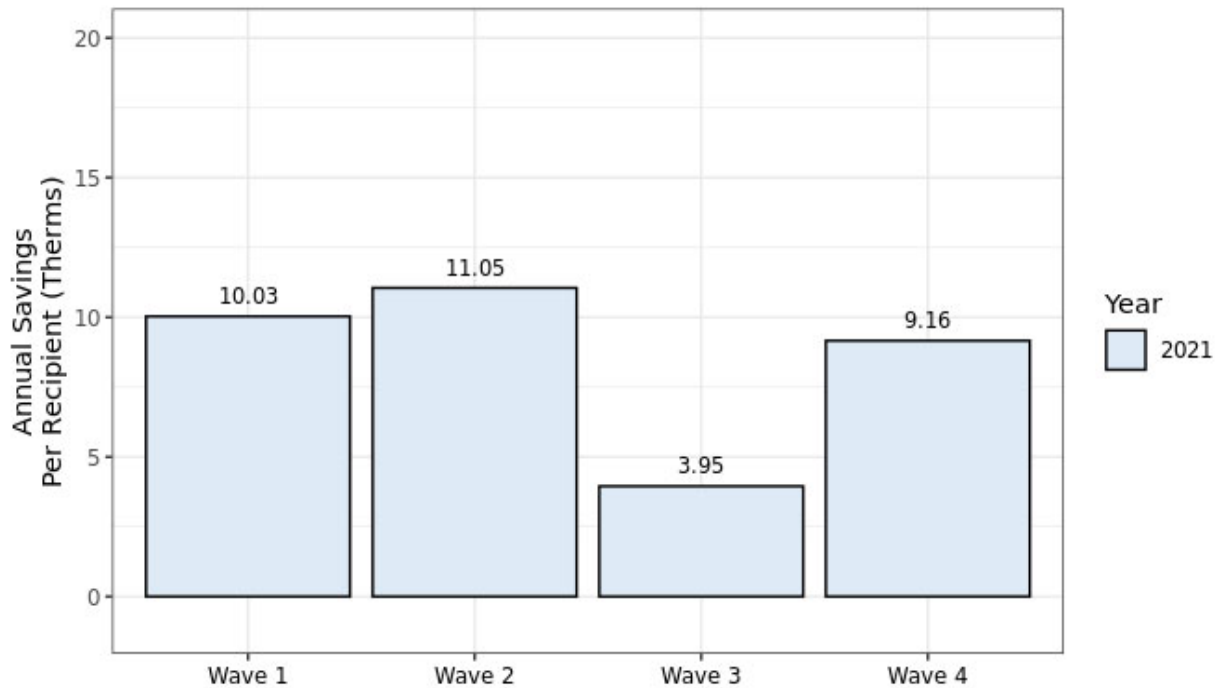


Figure 6-4 Daily Consumption between Recipient & Control Group – Wave 4

### 1.26 Per-Customer Performance

The annual savings per recipient for each wave is shown in Figure 6-5. In PY2021, Wave 2 had the highest savings at 11.05 therms per recipient. The savings for Wave 1 were 10.03 therms. The savings for Wave 3 were 3.95 therms. Finally, the Wave 4 savings were 9.16 therms. Additionally, Wave 4 was the only wave that outperformed savings from PY2020.

Of all the PY2021 waves, Wave 3 had the lowest savings.



*Figure 6-5 Savings per Recipient*

Table 6-7 shows the savings per recipient for each wave at the both the lower and upper boundaries of the 95% confidence interval. Additionally, the annual pre-period usage per recipient and the percent of annual usage is provided below. The savings for each wave were calculated in the 0.69 – 1.72% range, consistent with expected general program performance and program performances in previous years.

*Table 6-7 Pre-Period Usage per Recipient and Percent of Annual*

Wave	Annual Savings per Recipient	Annual Savings (Lower 95% CI)	Annual Savings (Upper 95% CI)	Annual Pre-Period Usage per Recipient	Percent Weight of Total Participants	Percent of Annual Therms
1	10.03	5.89	14.18	757.57	40.72%	1.32%
2	11.05	7.28	14.81	722.18	18.43%	1.53%
3	3.95	0.55	7.36	573.23	16.98%	0.69%
4	9.16	6.62	11.71	533.27	23.86%	1.72%
All	8.98	5.41	12.55	645.66	-	1.39%

### 1.27 Double Counting Analysis

Protocol J in AR TRM V8.2 specifies double counting as the difference in per-participant other-program savings.

Double counted savings is the difference in other-program-savings for the recipient and control groups, and this difference is subtracted from a behavioral program estimate to avoid double counting. If a program has more recipients than non-recipients in the analysis, then taking the

straight sum of savings from other-program-savings would dramatically inflate the double counting effect.

Table 6-8 shows the calculated PY2021 program savings after adjusting for double-counting.

*Table 6-8 PY2021 Program Savings Before and After Double Counting*

<i>Program Year</i>	<i>Ex-post Therms Before Double Counting</i>	<i>Percent Difference</i>	<i>Ex-post Therms After Double Counting</i>
2021	315,489	+ 1.70%	320,867

## 1.28 Verified Savings

the Home Energy Reports Program has 320,867 annual therms savings in 2021, shown in Table 6-9.

*Table 6-9 HER Program Savings*

<i>Ex-ante Therms</i>	<i>Ex-post Therms</i>	<i>Realization Rate</i>	<i>95% Confidence Therms</i>	<i>Precision</i>
320,867	320,867	100.0%	42,260	13.4%

The overall program realization rate for PY2021 is 100.0%.

Additionally, the overall program savings are shown on a per-wave basis in Table 6-10 where the lower and upper bounds at the 95% confidence interval are calculated.

*Table 6-10 HER Program Savings at 95% Confidence*

<i>Wave</i>	<i>Weighted Number of Participants</i>	<i>Ex-post Therms</i>	<i>Ex-post Therms (Lower 95% CI)</i>	<i>Ex-post Therms (Upper 95% CI)</i>
1	14,306.2	145,997	85,652	206,341
2	6,475.9	72,758	47,976	97,541
3	5,966.2	23,989	3,334	44,644
4	8,382.7	78,123	56,433	99,813
<b>All</b>	<b>35,130.9</b>	<b>320,867</b>	<b>193,395</b>	<b>448,338</b>

Table 6-11 summarizes the annual gross and net savings by wave.

*Table 6-11 Therms Savings Summary by Wave*

<i>Wave</i>	<i>Number of Total Participants</i>	<i>Annual Therms Usage</i>	<i>Ex-post Savings</i>	<i>Savings as a Percent of Annual</i>
1	14,776	10,837,961	143,550	1.32%
2	6,722	4,676,751	71,539	1.53%
3	6,252	3,420,009	23,587	0.69%
4	9,132	4,470,252	76,814	1.72%
<b>All</b>	<b>36,882</b>	<b>23,404,972</b>	<b>315,489</b>	<b>1.39%</b>

When aggregating across all waves, the Evaluators found that the overall 95% confidence interval was  $\pm 9.5\%$  of program savings. In addition, across all waves, the overall program savings were 1.39% of annual usage.

## 7. Low-Income Saving Homes Program

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The Low-Income Saving Homes Program (LISHP) provides weatherization services to hard-to-reach customers. The program is administered in partnership with Public Service Company of Oklahoma (PSO).

Direct install measures include:

- Water heater pipe insulation, and
- Water heater jackets.

Weatherization measures include:

- Air infiltration,
- Duct sealing, and
- Ceiling insulation.

The program is implemented by Titan ES in partnership with PSO.

### 1.29 Program Background

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The LISHP is intended to be primarily vendor-driven program, with the marketing targeted at contractors in the Summit Energy service territory.

### 1.30 Participation Summary

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The LISHP had 243 participants in PY2021, and a total of 661 energy efficiency improvements were installed overall.

Figure 7-1 summarizes the share of program savings contributed by each measure. Most of the program savings were generated by duct sealing, ceiling insulation, and air infiltration.

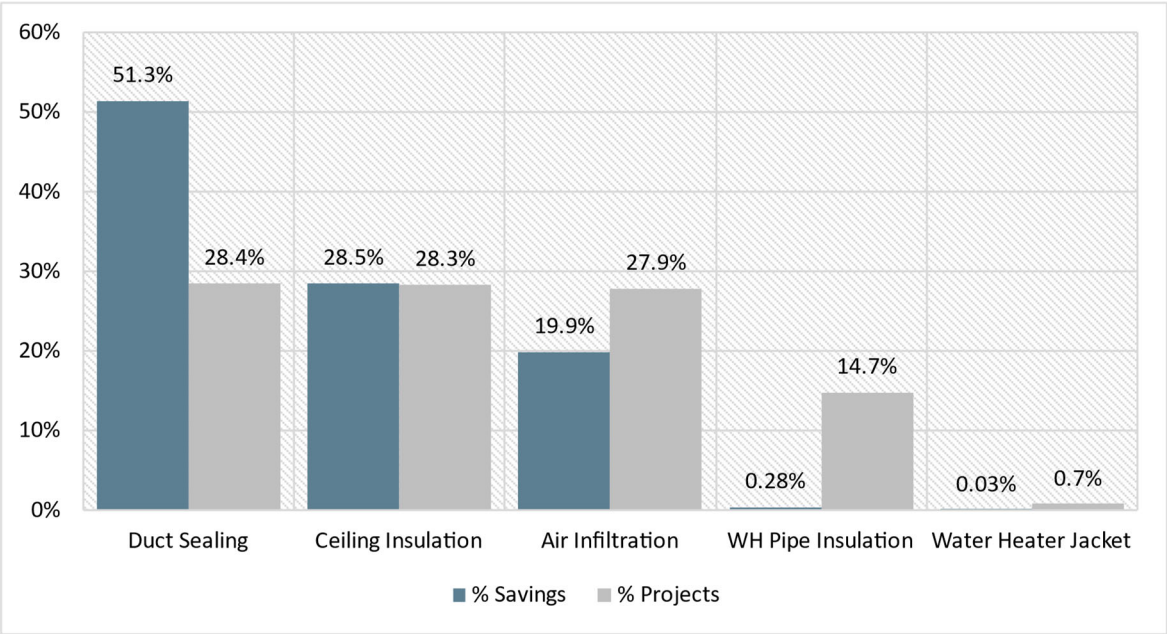


Figure 7-1 Program Summary by Savings Share and Participation

In addition, incentives were provided for 209 Health & Safety assessment measures at 209 homes.

1.30.1 Participation Timing

Figure 7-2 summarizes the premises by month as determined by the date of rebate delivery as well as the cumulative savings from the program.

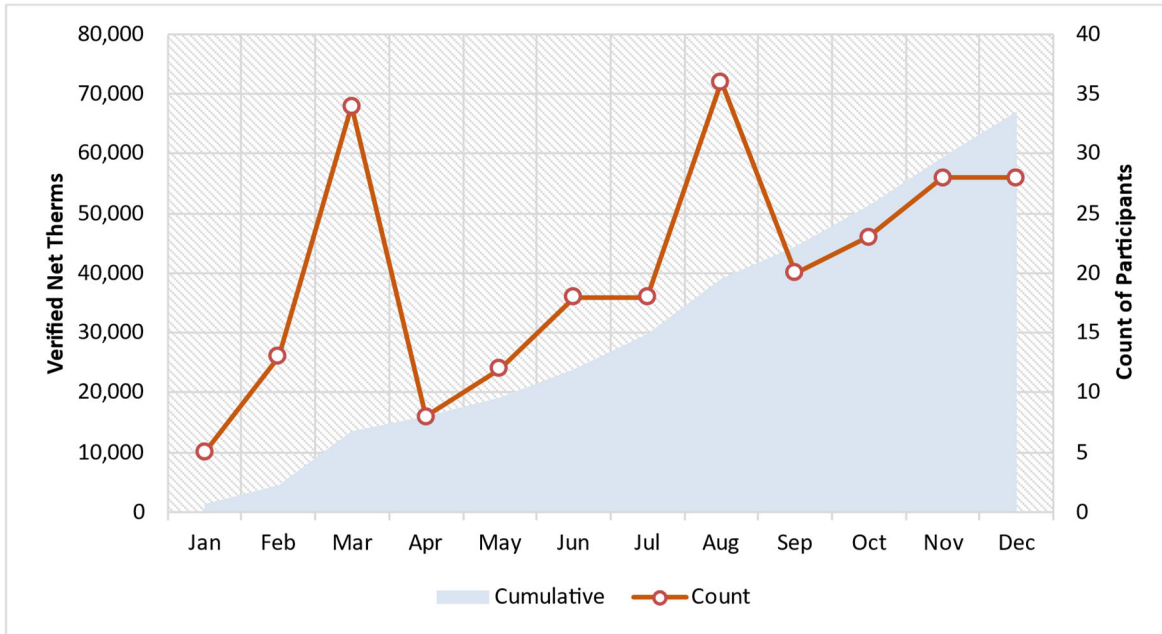


Figure 7-2 LISHP Cumulative Savings and Participants by Month

### 1.30.2 Quality Assurance

Staff at CLEAResult conducts post inspections at a minimum of 10% of the projects completed by each trade ally. Post inspections are conducted by a quality assurance specialist. The post-inspection procedure includes designations of major violations and minor violations for each measure.

- Major violations require immediate resolution which may include charging the contractor back for the coupon amount.
- Minor violations may be resolved without coupon chargeback.

The definition of major and minor violations by measure are summarized in Table 7-1.



*Table 7-1 QA Violation Definitions by Measure*

<b>Measure</b>	<b>Definitions</b>
Direct install	Major violation examples: <ul style="list-style-type: none"> <li>■ Verified devices installed does not match claimed devices installed.</li> <li>■ Device installed on an appliance of non-eligible fuel type</li> <li>■ Installation of direct install equipment results in damage or inoperability of existing equipment</li> </ul>
	Minor violation examples: <ul style="list-style-type: none"> <li>■ None</li> </ul>
Insulation	Major violation examples: <ul style="list-style-type: none"> <li>■ Stated existing R-value: error &gt; 1 step difference in R-value range chart on the coupon.</li> <li>■ Stated finished R-value: error of &gt; 10% in R-value</li> <li>■ Stated square footage: error of &gt;10% in square feet</li> </ul>
	Minor violation examples: <ul style="list-style-type: none"> <li>■ Improper installation of new insulation (such as varying depths)</li> <li>■ Bag count card not properly displayed</li> <li>■ Depth markers not properly displayed</li> </ul>
Duct sealing/air sealing	Major violation examples: <ul style="list-style-type: none"> <li>■ Starting vs. finished air leakage rate: verification reveals discrepancy &gt; 20%</li> <li>■ Minimum Ventilation Requirement (MVR): failure to identify correct MVR or take proper action in the event of the MVR not being met</li> <li>■ Duct sealing or air sealing materials: use of improper materials</li> <li>■ Combustion Safety Test (CST): not performing the CST or failing to take proper action on the results.</li> </ul>
	Minor violation examples: <ul style="list-style-type: none"> <li>■ None</li> </ul>

### 1.31 LISHP Impact Evaluation

The evaluation effort of the LISHP included:

- *Desk review of residential calculations.* The Evaluators utilized AR TRM 8.2 values in assessing savings from measures included in the program.
- *Field verification.* Due to COVID-19, the Evaluators were unable to conduct in-person site visits to determine field verification rates. Instead, the Evaluators used a three-year average of field verification rates from PY17 through PY19 from the SHP and applied those values to LISHP.

#### 1.31.1 Tracking Data Review

The impact evaluation began with a review of program tracking data. The tracking data included a separate row for each measure installed. Every premise in the program had a unique rebate

identifier, and thus one premise would have multiple rows to reflect the different measures completed. Table 7-2 summarizes ex ante savings by measure for the LISHP.

*Table 7-2 LISHP Ex Ante Summary*

Measure	Ex Ante Therm
Duct Sealing	35,403
Ceiling Insulation	19,469
Air Infiltration	13,651
Pipe Insulation	190
Water Heater Jacket	20
<b>Total</b>	<b>68,733</b>

The tracking data provided measured values for duct pressurization testing and blower door tests, allowing for the recreation of ex ante calculations based on leakage reduction. Further, the tracking data was found to include detailed parameters for all measures, such as baseline R-value for ceiling insulation.

### **1.31.2 Field Verification Procedures**

Due to COVID-19, the Evaluators were unable to perform in-person site visits to determine field verification rates (FVRs) for projects in PY2021. As a result, the Evaluators have reviewed the site visits from PY2017, PY2018, and PY2019 (72 total sites) completed as part of evaluation of the CenterPoint Arkansas Saving Homes Program and applied the average of the three years to result in measure-level FVRs. These results are summarized in Table 7-3.

*Table 7-3 Three Year Average Applied to PY2021*

Measure	SHP PY2017 FVR	SHP PY2018 FVR	SHP PY2019 FVR	SHP PY2021 FVR
Duct Sealing	100.0%	N/A	N/A	100.0%
Ceiling Insulation	95.0%	101.1%	97.6%	97.9% / 100.0%
Air Infiltration	100.0%	100.0%	100.0%	100.0%
Pipe Insulation	95.9%	100.3%	102.5%	99.6% / 100.0%
Water Heater Jacket	100.0%	100.0%	100.0%	100.0%

### **1.31.3 Net Savings Estimates**

The NTGR for the LISHP is 100% due to the program's emphasis on targeting hard-to-reach customers.

#### **1.31.3.1 Direct Install Measures Free Ridership Methodology**

Due to the low volume of direct install measures (which accounted for 0.31% of verified savings) the Evaluators did not develop a separate NTGR. DI measures received the 100.0% NTGR developed for the weatherization measures.

### 1.31.4 Verified Savings

Table 7-4 presents the gross savings results of the evaluation of the PY2021 Low-Income Saving Homes Program. Total gross savings summarizes the savings calculations performed by AR TRM 8.2 protocols for program measures.

*Table 7-4 LISHP Verified Savings Summary*

<i>Measure</i>	<i>Ex Ante Therms</i>	<i>Ex Post Therms</i>	<i>Gross Realization</i>	<i>EUL</i>	<i>Lifetime Therms</i>
Duct Sealing	35,403	34,461	97.3%	18	620,299
Ceiling Insulation	19,469	19,153	98.4%	20	383,051
Air Infiltration	13,651	13,348	97.8%	11	146,832
Pipe Insulation	190	190	100.0%	11	2,092
Water Heater Jacket	20	20	100.0%	13	257
<b>Total</b>	<b>68,733</b>	<b>67,172</b>	<b>98.7%</b>	<b>17.1</b>	<b>1,152,274</b>

*Table 7-5 LISHP Net Savings Summary*

<i>Free-Ridership Rate</i>		<i>Net Annual Savings</i>		<i>Net Realization Rate</i>	<i>EUL</i>	<i>Net Lifetime Therms Savings</i>
<i>Ex Ante</i>	<i>Ex Post</i>	<i>Ex Ante</i>	<i>Ex Post</i>			
0.00%	0.00%	68,733	67,172	97.7%	17.1	1,152,532

## 8. Low Flow Showerhead & Faucet Aerator Program

The Low Flow Showerhead & Faucet Aerator Program provides no-cost mailer kits to Summit residential customers. These kits may contain:

- Up to three 1.5 gallons per minute (GPM) low flow showerheads, available in chrome and ivory finish; and
- Up to three faucet aerators, with options including 1.5 GPM kitchen aerators (with a shutoff valve) and 1.0 GPM bathroom aerators (without a shutoff valve).

### 1.32 Program Background

The Low Flow Showerhead and Faucet Aerator Program is designed to provide no-cost kits containing low flow showerheads and faucet aerators to Summit residential customers. These kits are then self-installed. The program has been markedly popular among Summit customers.

### 1.33 Low Flow Showerhead and Faucet Aerator Program Participation Summary

In 2021, Summit distributed 1,007 kits to their residential customers. Table 8-1 presents a summary of the composition of the kits installed. The table is organized showing first the number of customers by showerhead, then how many aerators were ordered by customers that ordered that specified number of showerheads.

*Table 8-1 Low Flow Kit Composition*

<i>Showerheads</i>		<i>Bathroom Aerators</i>		<i>Kitchen Aerators</i>	
<i>Quantity</i>	<i>% Selected</i>	<i>Quantity</i>	<i>% Selected</i>	<i>Quantity</i>	<i>% Selected</i>
0	30.69%	0	89.97%	0	85.76%
		1	5.18%	1	12.62%
		2	3.88%	2	1.29%
		3	0.97%	3	0.32%
1	31.38%	0	70.25%	0	64.24%
		1	23.73%	1	33.23%
		2	6.01%	2	1.58%
		3	0.00%	3	0.95%
2	20.75%	0	64.11%	0	57.42%
		1	14.35%	1	38.76%
		2	19.14%	2	3.35%
		3	2.39%	3	0.48%
3	17.18%	0	39.88%	0	35.26%
		1	21.39%	1	39.88%
		2	31.79%	2	11.56%
		3	6.94%	3	13.29%

### 1.34 Low Flow Showerhead & Faucet Aerator Program Impact Evaluation

#### 1.34.1 Energy Savings Calculations

Savings from low flow showerheads are calculated by the following process:

- First, the Evaluators total the per-unit savings as determined by AR TRM 8.2 algorithms which incorporate weather-zone specific ground water temperatures, and an assumed mixed water temperature of 104.3 deg. F for the water heater.
- Further, these values are scaled down by the verified In-Service Rate. This is the percent of distributed equipment installed. This is determined separately for each item in the kit (showerheads, kitchen aerators, and bathroom aerators).
- The Evaluators then parse out the savings based on the percent of electric vs. gas water heating as determined through the participant surveys. This serves to provide a weighted average value of energy savings based upon the electric and natural gas savings algorithms for each measure as indicated in AR TRM 8.2.

#### 1.34.2 Unit Energy Savings

##### 1.34.2.1 Faucet Aerators

Savings from faucet aerators are based upon AR TRM 8.2 values. Savings for faucet aerators are calculated as follows:

$$\text{Energy Savings} = \frac{\rho \times C_p \times V \times (T_{Mixed} - T_{Supply}) \times \left(\frac{1}{RE}\right)}{\text{Conversion Factor}}$$

Where,

$\rho$  = Water density, 8.33 lbs./gal.

$C_p$  = Specific heat of water, 1 BTU/lb.°F

$V$  = DHW gallons saved / yr. / faucet

$V$  = gallons of hot water saved per year per faucet

= 533

× (2.2

– gpm) where GPM is the flow rate of the new aerator. This formula is a linear extrapolation of values in.

$T_{SetPoint}$  = Mixed water temperature (default value 102.6°F)

$T_{Supply}$  = Average supply water temperature

$RE$  = Recovery efficiency of water heater, excluding standby losses (.98 electric / 0.79 Gas).

*Conversion Factor* = 3,412 BTU/kWh for electric water heating or 100,000 BTU/Therms for gas water heating.

*Table 8-2 Faucet Aerator Volume of Use*

<i>Parameter</i>	<i>Value</i>
Faucet use gallons/person/day (baseline)	9.7
Faucet use gallons/person/day (1.5 GPM)	8.2
Faucet use gallons/person/day (1.0 GPM)	7.2
Occupants per home	2.53
Faucets per home	3.86
Gal./yr./faucet (Baseline)	2,321
Gal./yr./faucet (1.5 GPM)	1,962
Gal./yr./faucet (1.0 GPM)	1,722
Mixed Water Temperature	105.3°F
DHW gallons saved/yr./faucet for 1.5 GPM (V)	359
DHW gallons saved/yr./faucet for 1.0 GPM (V)	599

#### **1.34.2.2 Low Flow Showerheads**

Savings for low flow showerheads are detailed in Section 2.3.5 of the AR TRM 8.2. They are calculated in the same manner as faucet aerators, differing only in the volume of use estimates.

*Table 8-3 Showerhead Volume of Use*

<i>Parameter</i>	<i>Value</i>
Average Shower Duration (minutes)	8.3
Gallons/shower @ 2.5 GPM (baseline)	20.7
Gallons/shower @ 2.0 GPM	16.5
Gallons/shower @ 1.5 GPM	12.4
Showers/person/day (baseline)	.69
Showers/person/day(post)	.72
Occupants per home	2.53
Showers/home/day (baseline)	1.62
Showers/home/day(post)	1.93
Showerheads per home	1.62
Showers per showerhead per day (baseline)	1.16
Showers per showerhead per day (post)	1.19
Gal./yr./showerhead @ 2.5 GPM (baseline)	8,142
Gal./yr./showerhead @ 1.5 GPM	5,089
Mixed Water Temperature	107.1 °F
1.5 GPM showerhead DHW gallons saved/yr. (V)	3,053

In addition, to account for the customers with electric water heating, the Evaluators incorporated the AR TRM 8.2.

### 1.34.3 In-Service Rates

The Evaluators applied in-service rates developed in 2016 based on CenterPoint Arkansas participant surveying. They are:

- Showerhead: 65.8%
- Kitchen aerator 66.2%
- Bathroom aerator: 57.6%

### 1.35 Net-to-Gross

The evaluators used CenterPoint Arkansas free ridership of 49.7% with spillover of 0.639 therms per kit.

### 1.36 Verified Savings

Table 8-4 summarizes the total gross savings and Table 8-5 summarizes the total net savings for the Low Flow Showerhead & Faucet Aerator Program.

*Table 8-4 Low Flow Showerhead & Faucet Aerator Program Verified Gross Savings*

<i>Measure Category</i>	<i>Annual Therms Savings</i>		<i>EUL</i>	<i>Lifetime Therms Savings</i>		<i>Gross Realization Rate</i>
	<i>Ex Ante</i>	<i>Ex Post</i>		<i>Ex Ante</i>	<i>Ex Post</i>	
Aerators	2,467	2,320	10	24,670	23,200	94.04%
Showerheads	18,608	14,321	10	186,080	143,210	76.96%
<b>Total Gross Savings</b>	<b>21,075</b>	<b>16,641</b>		<b>210,750</b>	<b>166,410</b>	<b>78.96%</b>

*Table 8-5 Low Flow Showerhead & Faucet Aerator Program Verified Net Savings*

<i>Measure Category</i>	<i>Net-to-Gross Ratio</i>		<i>Annual Therms Savings</i>		<i>EUL</i>	<i>Lifetime Therms Savings</i>	
	<i>Ex Ante</i>	<i>Ex Post</i>	<i>Ex Ante</i>	<i>Ex Post</i>		<i>Ex Ante</i>	<i>Ex Post</i>
Kit Savings	50.3%	50.3%	20,295	8,923	10	202,950	89,230
<b>Total Net Savings</b>			<b>20,295</b>	<b>8,923</b>	<b>10</b>	<b>202,950</b>	<b>89,230</b>

Table 8-6 summarizes the net non-energy benefits from the 2021 Low Flow Showerhead & Faucet Aerator Program.

*Table 8-6 Low Flow Showerhead & Faucet Aerator Program Net Non-Energy Benefits Summary*

<i>Non-Energy Benefit</i>	<i>Annual</i>	<i>EUL</i>
Water Savings (Gallons)	399,403	10

## 9. Appendix A: Site Reports

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This appendix contains the individual site reports for Commercial Solutions Program.



<b>Program</b>	C&I Solutions
<b>Project ID</b>	CNPOK-2021-007
<b>Facility SIC Code</b>	2047 – Dog and Cat Food
<b>Measures</b>	Pipe Insulation
<b>Annual Consumption</b>	236,360 therms

## Project Background

The participant is a pet food manufacturer that received incentives from CenterPoint Energy for:

- ECM #1 – Pipe Insulation

The steam system serves the facility's typical systems, including space heat, sanitization, and laundry. The Pipe insulation measure saved energy by reducing the heat loss from the piping and joints/values, thus reducing the gas consumption.

## M&V Methodology

The M&V effort for this project follows the guidelines of the 2012 International Performance Measurement and Verification Protocol (IPMVP) Option A - Retrofit Isolation: Key Parameter Measurement. ADM evaluated the savings associated with this site during a desk review.

## Pipe Insulation

Through this method, energy savings are calculated using key data and through the North American Insulation Manufacturers Association's 3E Plus software: (<http://www.pipeinsulation.org/>).

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 1.5 in insulation (post-retrofit). The software required these inputs: process temperature, ambient temperature, pipe size, base metal, insulation, and jacket material. Annual therms savings was calculated using the following equation:

### *Equation 1. Pipe Insulation Installation Annual Energy Savings*

$$\text{Annual Therms Savings} = \frac{\text{Heat Loss} \left( \frac{\text{Btu}}{\text{hr}} \right) \times \text{Annual Operating Hours} \left( \frac{\text{hrs}}{\text{yr}} \right)}{\text{Boiler Efficiency} \times 100,000 \left( \frac{\text{BTU}}{\text{CCF}} \right)}$$

Where:

*Annual Operating Hours* = number of hours facility operates annually

*Boiler Efficiency*

*100,000 Btu/CCF* = conversion factor (BTU/yr to CCF/yr)

*Table 1. Tank/Pipe/Valve Insulation Parameters*

<i>Entry #</i>	<i>Description</i>	<i>Type</i>	<i>Quantity</i>	<i>Pipe Length / Valve Equivalent Length (ft)</i>	<i>Diameter (in)</i>
1	Feedwater Tank	Cylindrical Tank	1	5	3.33
2	1" Steam Pipe	Pipe	1	28	1
3	2" Feedwater Pipe	Pipe	1	25	2
4	4" Steam Valve	Valve	1	3.47	4
5	6" Steam Valve	Valve	1	3.58	6
6	2.5" Steam Piping	Pipe	1	36	2.5
7	1.5" steam piping	Pipe	1	3	1.5

## Measure Life

*Table 2. Estimated Useful Life for Respective Measures*

<i>Measure</i>	<i>EUL</i>
Pipe Insulation	20 years

## Calculated Savings:

### *Pipe Insulation*

*Table 3. Pipe Insulation Annual Energy Savings*

<i>Entry #</i>	<i>Description</i>	<i>Pipe or Valve</i>	<i>Temperature (°F)</i>	<i>Pre Heat Loss</i>	<i>Post Heat Loss</i>	<i>Therms Savings</i>
1	Feedwater Tank	Cylindrical Tank	130	93.64	8.21	485.70
2	1" Steam Pipe	Pipe	332.6	282.80	33.68	568.05
3	2" Feedwater Pipe	Pipe	130	66.29	8.00	118.67
4	4" Steam Valve	Valve	332.6	886.50	102.90	216.55
5	6" Steam Valve	Valve	332.6	1,282.00	152.60	342.02
6	2.5" Steam Piping	Pipe	332.6	581.30	49.89	1,557.95
7	1.5" steam piping	Pipe	332.6	395.80	42.61	86.29

<i>Entry #</i>	<i>Description</i>	<i>Pipe or Valve</i>	<i>Temperature (°F)</i>	<i>Pre Heat Loss</i>	<i>Post Heat Loss</i>	<i>Therms Savings</i>
<b>Total:</b>						<b>3,355</b>

Overall, project savings are as follows:

*Table 4. Overall Project Savings*

<i>Measure</i>	<i>Expected Annual therms Savings</i>	<i>Realized Annual therms Savings</i>	<i>Realization Rate</i>	<i>Lifetime therms Savings</i>
Pipe Insulation	3,383	3,355	99%	67,091
<b>TOTAL</b>	<b>3,383</b>	<b>3,355</b>	<b>99%</b>	<b>67,091</b>

## Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of \$56,302. Measure payback is summarized in the table below.

*Table 5. Cost, Incentive, and Payback*

<i>Annual Therms Savings</i>	<i>Cost per Therm</i>	<i>Annual Energy Cost Savings</i>	<i>Incremental Cost</i>	<i>Base Incentive</i>	<i>Adjusted Incentive</i>	<i>Payback w/Incentive</i>	<i>Payback w/o Incentive</i>
3,355	\$0.95	\$3,214	\$6,400	\$3,213	3,213	1.7	3.4

<b>Program</b>	C&I Solutions
<b>Project ID</b>	CNPOK-2021-008
<b>Facility SIC Code</b>	2951 – Asphalt Paving Mixtures and Blocks
<b>Measures</b>	Burner Controls VFD Exhaust Control
<b>Annual Consumption</b>	333,527 therms

## Project Background

The participant is a facility that produced asphalt for construction applications that received incentives from CenterPoint Energy for:

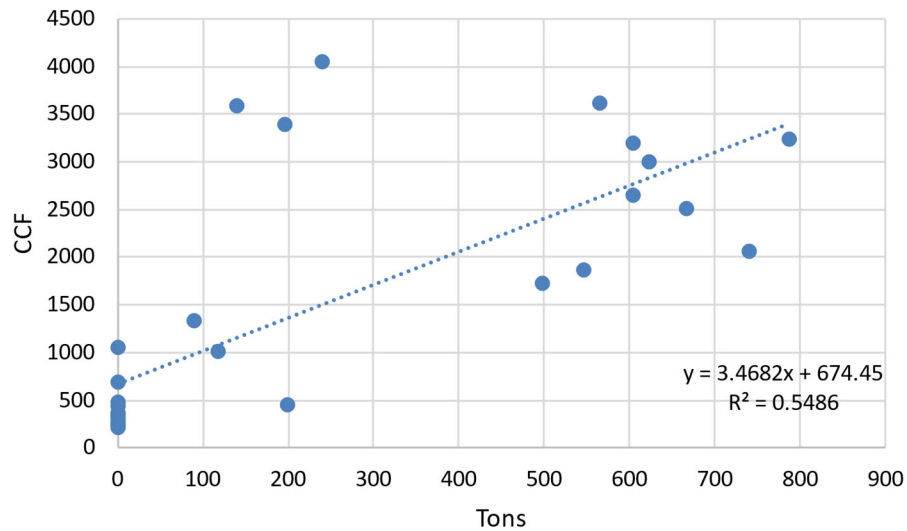
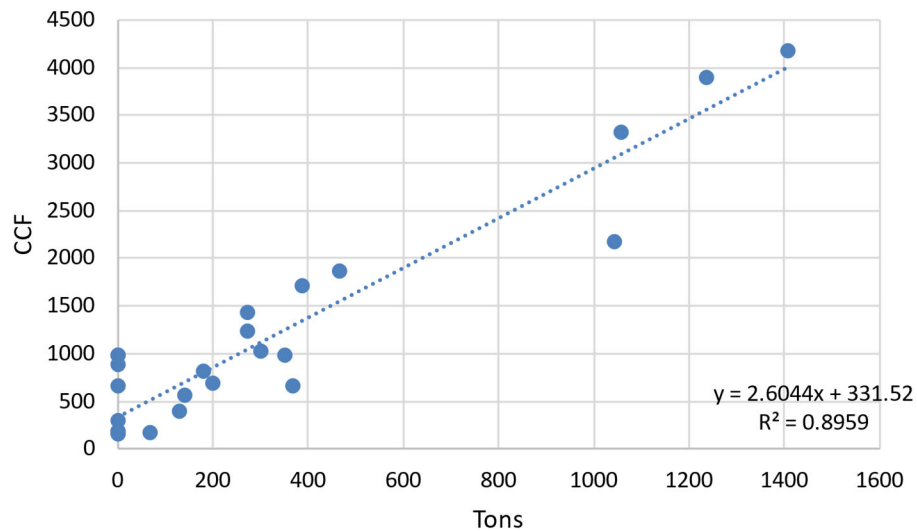
- ECM #1 – Burner controls
- ECM #2 – VFD Exhaust Control

Customer upgraded controls and burner on their asphalt kiln and replacing the damper controls on the kiln's blower with a VFD. New controls allow for tighter temperature regulation while the new burners are more efficient using less natural gas for the same BTU output.

## M&V Methodology

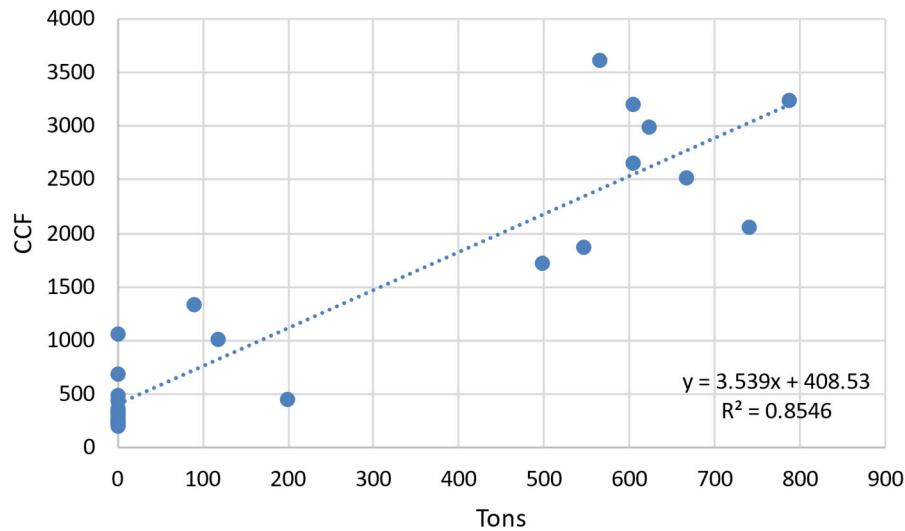
The M&V effort for this project follows the guidelines of the 2012 International Performance Measurement and Verification Protocol (IPMVP) Option C – Whole Facility. ADM evaluated the savings associated with this site during a desk review. The implementer provided 31 days of baseline trend data and 31 days of post trend data.

The trend data was then plotted to show the relationship between CCF consumption and tons produced by the facility.

*Figure 1: Baseline Production Data**Figure 2: Post-Production Data*

A Z-score was then calculated of the CCF/Tons to identify any statistical outliers that would cause the skew the regression models. Any data point that had a Z-score greater than 1.2 was considered a statistical outlier and was removed from the regression model. The table below shows the baseline trend data with the outliers removed.

Figure 3: Updated Baseline Production Data



The post-production data was then annualized to represent a typical year's production data and then the post regression model was used to model what the natural gas consumption would be to produce the annualized production data.

#### Equation 2: Post Annual Therms

$$\text{Actual therms} = [(\text{Post Production (tons)} / \# \text{ of Days}) \times 365 \text{ days}] \times (A + B)$$

Where:

A = post-production coefficient

B = intercept

The baseline regression model was then used to model what the natural gas consumption would be to produce the annualized production data from the post period.

#### Equation 3: Baseline Annual therms

$$\text{Baseline therms} = \left[ \left( \frac{\text{Post Production (tons)}}{\# \text{ of Days}} \right) \times 365 \frac{\text{days}}{\text{yr}} \right] \times C + D$$

Where:

C = pre-production coefficient

D = intercept

#### Equation 4: Total Savings

$$\text{Savings [therms]} = \text{Baseline therms} - \text{Actual therms}$$

## Measure Life

Table 1. Estimated Useful Life for Respective Measures

<i>Measure</i>	<i>EUL</i>
Burner Controls	12 years
VFD Control	15 years

## Calculated Savings:

Table 2. Total Annual Energy Savings

<i>Entry #</i>	<i>Yearly Energy Consumption PRE</i>	<i>Yearly Energy Consumption POST</i>	<i>Therms Savings</i>
1	340,062	250,288	89,774

Overall, project savings are as follows:

Table 3. Overall Project Savings

<i>Measure</i>	<i>Expected Annual therms Savings</i>	<i>Realized Annual therms Savings</i>	<i>Realization Rate</i>	<i>Lifetime therms Savings</i>
Burner Controls	10,181	10,980	108%	131,758
Exhaust VFD	73,058	78,794	108%	1,181,914
<b>TOTAL</b>	<b>43,720</b>	<b>43,720</b>	<b>100%</b>	<b>524,640</b>

## Measure Cost, Incentive, & Payback

The Evaluators reviewed the invoices associated with this project and verified a cost of \$73,077. Measure payback is summarized in the table below.

Table 4. Cost, Incentive, and Payback

<i>Annual Therms Savings</i>	<i>Cost per Therm</i>	<i>Annual Energy Cost Savings</i>	<i>Incremental Cost</i>	<i>Base Incentive</i>	<i>Adjusted Incentive</i>	<i>Payback w/Incentive</i>	<i>Payback w/o Incentive</i>
83,239	\$0.52	\$46,404	\$73,077	\$79,077	\$85,285	1.0	1.5



<b>Program</b>	C&I Solutions
<b>Project ID</b>	CNPOK-2021-007
<b>Facility SIC Code</b>	2819 - Industrial Inorganic Chemicals
<b>Measures</b>	Pipe Insulation
<b>Annual Consumption</b>	576,635 therms

## Project Background

The participant is a catalyst production and recycling facility that received incentives from CenterPoint Energy for:

- ECM #1 – Tank Insulation

The insulation was installed around the four regen units. The tank insulation measure saved energy by reducing the heat loss from the regen units, thus reducing the gas consumption.

## M&V Methodology

The M&V effort for this project follows the guidelines of the 2012 International Performance Measurement and Verification Protocol (IPMVP) Option A - Retrofit Isolation: Key Parameter Measurement. ADM evaluated the savings associated with this site during a desk review.

### Pipe Insulation

Through this method, energy savings are calculated using key data and through the North American Insulation Manufacturers Association's 3E Plus software: (<http://www.pipeinsulation.org/>).

The 3E Plus software was used to calculate heat loss (btu/hr/ft) for bare piping (pre-retrofit) and piping with 1.5 in insulation (post-retrofit). The software required these inputs: process temperature, ambient temperature, pipe size, base metal, insulation, and jacket material. Annual therms savings was calculated using the following equation:

## Equation 5. Pipe Insulation Installation Annual Energy Savings

$$\text{Annual Therms Savings} = \frac{\text{Heat Loss} \left( \frac{\text{Btu}}{\text{hr}} \right) \times \text{Annual Operating Hours} \left( \frac{\text{hrs}}{\text{yr}} \right)}{\text{Boiler Efficiency} \times 100,000 \left( \frac{\text{BTU}}{\text{CCF}} \right)}$$

Where:

*Annual Operating Hours* = number of hours facility operates annually

*Boiler Efficiency*

*100,000 Btu/CCF* = conversion factor (BTU/yr to CCF/yr)

Table 1. Tank/Pipe/Valve Insulation Parameters

Entry #	Description	Type	Quantity	Length Ft	Width Ft	SF Total
1	Line item #1	Cylindrical Tank	8	3.34	5.33	142
2	Line item #2	Cylindrical Tank	8	3.34	5.83	156
3	Line item #3	Cylindrical Tank	2	3.67	3.67	27
4	Line item #4	Cylindrical Tank	4	4.75	0.67	13
5	Line item #5	Cylindrical Tank	5	4.75	1.25	30
6	Line item #6	Cylindrical Tank	4	4.75	3.5	67
7	Line item #7	Cylindrical Tank	4	4.75	1.5	29
8	Line item #8	Cylindrical Tank	1	4.75	4	19
9	Line item #9	Cylindrical Tank	2	5.83	3.17	37
10	Line item #10	Cylindrical Tank	2	5.83	2.67	31
11	Line item #11	Cylindrical Tank	2	9	2.17	39
12	Line item #12	Cylindrical Tank	8	5.67	1.67	76
13	Line item #13	Cylindrical Tank	2	20.83	3.33	139
14	Line item #14	Cylindrical Tank	4	15.7	5	314

## Measure Life

Table 2. Estimated Useful Life for Respective Measures

Measure	EUL
Pipe Insulation	20 years

**Calculated Savings:*****Pipe Insulation***

Table 3. Pipe Insulation Annual Energy Savings

<i>Entry #</i>	<i>Description</i>	<i>Pipe or Valve</i>	<i>Temperature (°F)</i>	<i>Pre Heat Loss</i>	<i>Post Heat Loss</i>	<i>Therms Savings</i>
1	Line item #1	Cylindrical Tank	475	1394.98	147.95	8,284
2	Line item #2	Cylindrical Tank	475	1394.98	147.95	9,060
3	Line item #3	Cylindrical Tank	475	1394.98	147.95	1,566
4	Line item #4	Cylindrical Tank	475	1394.98	147.95	738
5	Line item #5	Cylindrical Tank	475	1394.98	147.95	1,729
6	Line item #6	Cylindrical Tank	475	1394.98	147.95	3,873
7	Line item #7	Cylindrical Tank	475	1394.98	147.95	1,660
8	Line item #8	Cylindrical Tank	475	1394.98	147.95	1,107
9	Line item #9	Cylindrical Tank	475	1394.98	147.95	2,152
10	Line item #10	Cylindrical Tank	475	1394.98	147.95	1,812
11	Line item #11	Cylindrical Tank	475	1394.98	147.95	2,272
12	Line item #12	Cylindrical Tank	475	1394.98	147.95	4,401
13	Line item #13	Cylindrical Tank	475	1394.98	147.95	8,089
14	Line item #14	Cylindrical Tank	475	1394.98	147.95	18,289
<b>Total:</b>						<b>65,030</b>

Overall, project savings are as follows:

Table 4. Overall Project Savings

<i>Measure</i>	<i>Expected Annual therms Savings</i>	<i>Realized Annual therms Savings</i>	<i>Realization Rate</i>	<i>Lifetime therms Savings</i>
Pipe Insulation	65,032	65,030	100%	1,300,607
<b>TOTAL</b>	<b>65,032</b>	<b>65,030</b>	<b>100%</b>	<b>1,300,607</b>

**Measure Cost, Incentive, & Payback**

The Evaluators reviewed the invoices associated with this project and verified a cost of \$31,944. Measure payback is summarized in the table below.

Table 5. Cost, Incentive, and Payback

<i>Annual Therms Savings</i>	<i>Cost per Therm</i>	<i>Annual Energy Cost Savings</i>	<i>Incremental Cost</i>	<i>Base Incentive</i>	<i>Adjusted Incentive</i>	<i>Payback w/Incentive</i>	<i>Payback w/o Incentive</i>
65,030	\$0.40	\$26,012	\$31,944	\$61,779	\$61,779	0.1	1.22